AUTOMOTIVE INDUSTRIES

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This Week

Italy has been on her toes in the development of roads. When the average roads of ten years ago are considered the pictures and description on page 82 of what they are today will astound you.

They do some things differently at the Ford plant and their cast alloy crankshafts have not escaped the drive for better methods and lower costs. Turn to page 86.

One manufacturer uses 90 per cent of all medium-carbon type of nickel-molybdenum steel produced. It is a story worth reading and starts on page 90.

The production of small automobile parts with a carrier system which synchronizes the movement through Bonderizing booths and bake ovens is told on page 94.

Output Steady Despite Odds

Heat and Drought Fail To Curb Motor Sales; One Independent Already Down for Retooling

Major automobile plants are continuing to operate near capacity and July schedules, repeatedly revised upward to care for the persistently strong retail demand, are being closely adhered to. The record-breaking heat that blanketed the Detroit region for seven consecutive days threatened early in the week to seriously curtail output. Plant foremen were authorized to poll their workmen and to shut down if the majority were in favor of stopping work.

On Monday and Tuesday a few cases were reported where plants closed late in the morning for the balance of the day when the heat became unbearable. On Wednesday following a 30 deg. temperature drop, production was again in full swing.

Retail sales so far this month are running very close to the June level. While it is too early to make any definite prediction, the best informed sales officials believe that July deliveries will be within 10 per cent of June figures. There has been no let up in the demand for cars in the lowest priced category and one of the "Big Three" is still behind on shipments against dealers orders.

Possible effects of the drought are a matter of speculation. Most sales officials are of the opinion that the great loss of farmer purchasing power in the arid regions will have but little influence on the sales figures of the country as a whole. The farming areas most seriously affected, they point out, are not important markets.

Other parts of the country, where crops are almost normal, will enjoy greater purchasing power as a result of higher prices. The only groups which will really lose are those engaged in transporting and processing agricultural produce. These will, of course, feel the pinch of the drought through the smaller volume they will handle.

Factory output continues at around 100,000 cars a week, and the total for the month is expected to be well over 400,000. A sharper drop will occur in August when many plants close down for retooling.

One of the independents, which has

(Turn to page 76, please)

Accomplishment *vs* Utopia

Macauley Cites Motors as Pacemaker of American Industry; Contrasts Results with Visionary Claims

Declaring that the factual accomplishments of the automobile industry are "a challenge in practical results to communism, socialism and false Utopias," Alvan Macauley, president of Packard Motor Car Co. and the Automobile Manufacturers Association, spoke before the annual meeting of the association in Detroit, July 15.

Pointing out that the automobile worker was making more per hour than in 1929, with living expenses 20 per cent lower, and that because of stabilization efforts he is enjoying a larger real annual income than in the boom year, Mr. Macauley labeled the motor industry as "the pacemaker of American Industry."

"The automobile industry," said Mr. Macauley, "bears no charmed life; it is not spared while others suffer depression. Its sales in the period 1930-1932 decreased 74.5 per cent, representing a shrinkage in wholesale value of $2,784,000,000.

"But during even the worst years the industry was never stagnant, and by its progressiveness and alertness was always ready to take full and rapid advantage of any change for the better. But inherent to the industry's methods and necessary to its success is the system of free competition under which this country has always developed."

Mr. Macauley continued with a citation of the progress the industry had made not only within itself but directly and indirectly throughout a vast number of other industries.

In conclusion the speaker said, "We are confronted in this country with the spread of communism. Many of the factors acting today as a deterrent on business and industry are socialistic in form and character. Contrasted with these conditions is the automobile industry's success in stimulating buying, increasing employment, stabilizing employment, raising wages and sharing other benefits with all employees.

(Turn to page 78, please)

Machine Tools Up 41%; Sales Near '29 Level

Machine tool orders in June rose to the highest level since 1929 and showed an increase of 41.3 per cent over June a year ago, and 8.3 per cent above the May figure. National Machine Tool Builders Association index for the month was 128.8 per cent, and the outlook for July is held very encouraging with most companies working at or near capacity.

They're Sitting Down Again!

Workers at Goodyear Continue Gandhi Tactics In Effort To Exclude Non-Union Group From Employment

Following a six-hour sitdown of Goodyear unionist employees which completely paralyzed Goodyear production July 14 Mayor Schroy of Akron declared the city would take drastic action if necessary to end the sitdown menace. The mayor announced that the entire Akron police force would be made available to aid Goodyear in keeping its plants operating without interruption, and summoned Goodyear and union officials into conference. The sitdown is said to have been a union protest against Goodyear employing non-union workers, and it is claimed that non-union employees were driven from the factory.

N. L. R. B. Cites Company

The National Labor Relations Board has issued a complaint charging the Goodyear Rubber Company with complicity in assaults at Gadsden, Alabama, on members and organizers of the United Rubber Workers of America. It is alleged that Goodyear foremen, supervisors and "flying squadron" members were encouraged by the company to make the attacks, one on the Rubber Workers' president, a second on workers within the walls of the Goodyear Gadsden plant, and a third on 11 union members trapped in a Gadsden office building by a mob.

Goodyear officers, the complaint states, found justification for this violence in the fact that similar treatment had been given members of the Goodyear "Industrial Assembly" by union workers at Akron. There, however, the company encouraged the arrest of the attackers on charges of inciting to riot, assaults and kidnapping, while at Gadsden the only company action taken was to discharge the victims of the acts of violence.

The discriminatory discharges of 12 union members at Gadsden are cited in the Board's complaint.

The charges cover events at both Akron and Gadsden. Threats to remove plants from Akron, where the Rubber Workers recently won a strike, are coupled with company statements that production may be increased in the less organized Gadsden plant.

Goodyear Says Charges Unfair

Officials of the Goodyear Tire & Rubber Co. issued July 13 the following statement replying to the National Labor Relations Board's complaint of July 11:

"The charges are unwarranted and unfair. Goodyear has repeatedly disclaimed any connection with the assault cases at Gadsden and it is significant that the tactics of one of the labor board's investigators in Gadsden drew from that city's governing commission a sharp charge of unfairness and prejudice.

"So far as the Industrial Assembly plan is concerned, it was instituted in 1919 and for many years has stood as a model of cooperation and harmony between management and employees. The Industrial Assembly continues to represent a vast majority of Goodyear employees despite the determined assaults of outside agitators. Under its operation Goodyear employees attained the highest wages among mass industries in addition to short hours, paid vacations, retirement pensions and many other unusual benefits.

"In the matter of decentralization Goodyear has refrained from any announcement of any preliminary plans. It is a fact that production in our Gadsden and other subsidiary plants has been stepped up because of diffi-

(*Turn to page 77, please*)

Thornton Equipped Chevrolet Demonstrates Truck Economy

The first truck economy run ever to be sanctioned and observed by the American Automobile Association, wherein the gross vehicle weight amounted to as much as 20 tons, took place between April 20 and May 12, 1936, when a Chevrolet truck, transformed into a six-wheeler by the installation of a Thornton Four Rear Wheel Drive, hauled, with semi-trailer, a payload of more than 15 tons from Detroit to Boston and back over a roundabout circuit of 2639.9 miles.

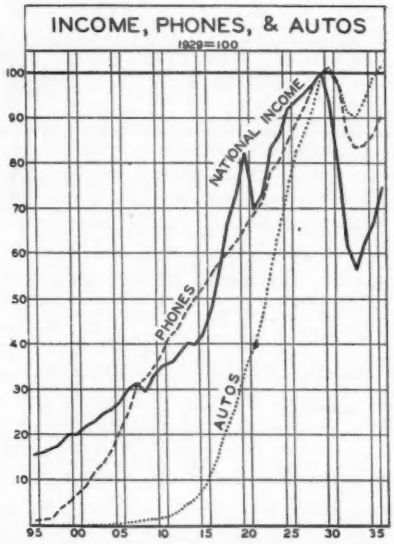
Fuel cost, oil consumption and road speed were the principal items under observation. Total gasoline consumed amounted to 515.95 gal., giving an average of 5.117 mi. per gal., at a total cost of $95.56. Oil used in the engine amounted to 3.7 qts., costing $1.11. The net running time was 134.01 hours and the average speed 19.70 m.p.h. It is calculated that the gasoline cost per vehicle mile was 3.62 cents. The gasoline cost per ton-mile of gross weight was 0.1720 cents and per ton-mile of net payload, 0.2364 cents. Fuel and oil cost per ton-mile of net payload amounted to 0.2392 cents.

From the technical point of view the gross-ton miles per gallon of gasoline is a factor of considerable interest, as it is a measure of the efficiency of the powerplant and transmission. This figures out to 102 ton-miles gross per gallon.

Major Bowes for Chrysler

Major Bowes and his amateurs will go on the air for Chrysler about the end of August. Details of the program are being worked out by Ruthrauff and Ryan, advertising agency. Probably institutional in character, the feature will go out over the Columbia broadcasting network.

Wheels Beat Wires!



National income has recovered only about 42 per cent of its depression losses, while the increase in automobile registrations represents 108 per cent of depression losses, according to Col. Leonard P. Ayres of the Cleveland Trust Co. Telephone installations, another indicator of American prosperity, have recovered about 40 per cent. The recovery figures are based on the years 1933-1936.

British Domestic Sales Show Substantial Rise

British domestic passenger car sales for April totaled 28,300 units compared with 25,552 units the same month a year ago. For May truck sales totaled 5730 units including 101 Diesel-powered vehicles, compared with 5495 in May, 1935. Buses and taxicabs sold in May totaled 680, of which 232 were Diesel-powered, compared with 796 the corresponding month last year.

Bob Crosby Featured On Ford Broadcasts

The Ford dealers of the United States inaugurated a new series of 13 quarter-hour radio programs commencing July 13. The transcribed programs, which are a continuation of the Ford V-8 Revue series, feature the music of Bob Crosby and his orchestra. Broadcasts are scheduled from one to three times a week and will be heard throughout the country.

John M. Alderfer

John M. Alderfer, 69, one of the founders and the first president of the India Tire & Rubber Co., Akron, died July 11 at his home in Sharon Center, Ohio. With three associates he founded the India Company in Akron in 1916, serving as president until 1928 when he became chairman of the board. He retired from active business several years ago.

F.W.D. Tractor Model T-40

Designed to Meet Rigid Length and Weight Requirements; Features Unusual Axle Weight Distribution

A new tractor truck of a gross-weight rating of 40,000 lb., designed to meet the increasing restrictions of highway regulations on tractor-trailer-combination length and axle weight, has been announced by the Four Wheel Drive Auto Co. By setting the front axle 53 in. back of the front bumper a favorable weight distribution has been obtained—10,000 lb. on the front axle, 15,000 lb. on the rear axle of the tractor and 15,000 lb. on the trailer axle. The tractor has a 130-in. wheelbase and has a maximum speed of 52 m.p.h. on level roads.

A 125-hp. engine is fitted, of 462 cu. in. displacement and a maximum torque of 324 lb-ft. The transmission is of the five-speed sliding-gear type with overdrive, and in direct drive the reduction ratio is 7.3 to 1. Other features include a 14-in. single-plate clutch, a transfer case with 5-in. silent chain, a center differential and propeller shafts with needle-bearing-type universal joints. Both front and rear axles are of the full-floating type. The frame is 36 in. above the ground. Tires are 9.75-20, singles front and duals rear. Service brakes are air-operated and in addition there is a set of parking brakes which acts on all four wheels through the driving mechanism. Front springs are 48 in. long, rear springs 56 in. Shock absorbers are carried on the front axle to improve the riding qualities.

Hudson Plans Quicker Service for Tourists

Hudson Motor Car Co. has taken steps to insure care-free travel for those traveling in Hudson and Terraplane cars. Under the direction of T. H. Stambaugh, general service manager, it has prepared a special program to assist dealers throughout the country in caring for the needs of tourists who visit their establishments.

The program provides for quick service on cars of tourists so that they will not be delayed and for providing them with road and route information along the way.

Willys Asks Go-Ahead On New Model Plans

Signalling marked progress in its plans for permanent reorganization of the Willys-Overland Co., attorneys of the firm have filed in federal district court last week an application for permission to spend $400,000 on machinery for the manufacture of a new model, to be lengthened in wheelbase, widened to standard tread, and to be priced under $500, according to reports. The firm is now operating under Section 77-B of the National Bankruptcy Act, but is expected to reorganize within a few days.

Production of the current line of cars will continue until the present court order for 15,000 cars has been exhausted. The factory is now about midway in production under the order and expects to complete its run sometime the latter part of August. About 66,000 cars have been produced under the federal receivership and reorganization proceedings, bringing dollar volume for the business up to the 29-million mark since receivership was imposed Feb. 15, 1933. The new models will probably be ready for the fall automobile shows, it was said.

Motor Use for Boxer Fund Proposed by Commissioner

For the purpose of developing larger markets for American automotive products, Miss A. Viola Smith, U. S. Trade Commissioner to China, made the proposal recently that a portion of the Boxer Indemnity Fund be used in enabling Chinese students to study highway engineering and allied subjects in American Universities.

The occasion was a meeting of automotive export executives at the offices of the Automobile Manufacturers Association on July 9, at which Henry E. Stebbins, U. S. Trade Commissioner to Great Britain, was also a speaker.

AMA Reelects Macauley

At the annual meeting the Automobile Manufacturers Association in Detroit this week, Alvan Macauley, president of the Packard Motor Car Co. was reelected president of the association. At the same time all other officers and directors were reelected.

Voicing their confidence that output this year would reach 4,600,000 cars and trucks, and be the second largest in history, members of the association presented Mr. Macauley with a silver platter in appreciation of his services as association president for the past eight years.

60 Marks to Eyston

Englishman Travels 6,545 Miles in 24 Hours on Utah Flats

Climaxing a series of new official speed records, Captain George Eyston brought his Rolls Royce racer to a stop on the Bonneville Salt Flats, July 14, after completing 6545 miles in 48 hr., at an average speed of 136.354 m.p.h. The previous record for the run was at a speed of 109.57 m.p.h. held by the Frenchmen, Perrot, Dhome and Girod.

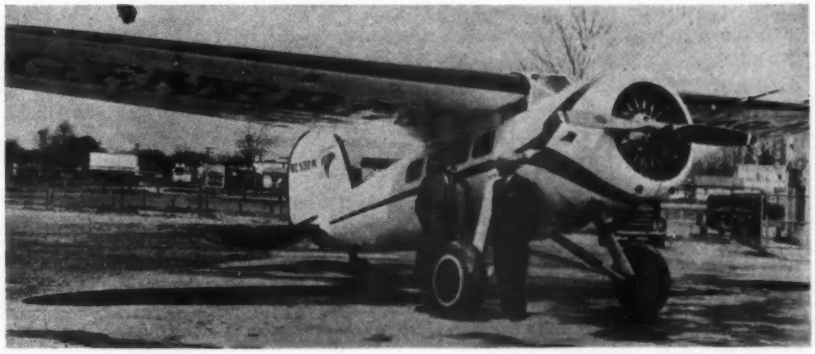
Last week in an entirely separate run, Captain Eyston topped his own 24-hr. record at a speed of 162.529 m.p.h. Altogether, more than 60 official records were chalked up during the runs. In addition to the 24 and 48-hr marks, the principal records to fall were:

5000	miles	at	142.61 m.p.h.
4000	miles	at	144.81 m.p.h.
3000	miles	at	149.054 m.p.h.
2000	miles	at	149.054 m.p.h.
1000	miles	at	152.138 m.p.h.
500	miles	at	152.343 m.p.h.

Twenty-Nine Makes in N. Y. Show; Trailer Section Planned

Twenty-three makes of passenger cars, six of trucks, will be on the floor when the National Automobile Show opens in New York on Armistice Day. Demand for space reduced size of allotments in some cases.

At least three makes of tourist trailers will be shown. The Diesel-engine and shop equipment exhibits will be larger than last year. Action at the factories, safety on the highways will dominate the decorations and exhibits.



General Tire & Rubber Co.'s "Miss Streamline," sister ship to the famous "Winnie Mae," has just completed its millionth mile in the service of company executives. W. O'Neil, president (left) and Ray Brown are standing by the plane

U. S. New Car Registrations and Estimated Dollar Volume by Retail Price Classes—April

UNITS — ESTIMATED DOLLAR VOLUME*

	1936	1935	Per Cent Change	Per Cent of Total 1936	Per Cent of Total 1935	1936	1935	Per Cent Change	Per Cent of Total 1936	Per Cent of Total 1935
Chevrolet, Ford and Plymouth	253,834	223,269	+ 13.8	63.93	69.86	$153,200,000	$142,100,000	+ 7.8	55.55	63.01
Others under $750	58,009	44,045	+ 32.0	14.61	13.78	41,900,000	31,700,000	+ 32.1	15.19	14.06
$751-$1000	65,675	41,197	+ 59.2	16.54	12.89	54,700,000	34,900,000	+ 57.0	19.83	15.48
$1001-$1500	16,884	7,964	+112.0	4.25	2.49	19,300,000	9,400,000	+105.5	7.00	4.17
$1501-$2000	1,247	1,660	− 25.0	.31	.52	2,200,000	2,700,000	− 18.5	.80	1.20
$2001-$3000	931	958	− 2.7	.23	.30	2,400,000	2,600,000	− 7.8	.87	1.15
$3001 and over	523	497	+ 5.1	.13	.16	2,100,000	2,100,000	None	.76	.93
Total	397,103	319,590	+ 24.2	100.00	100.00	$275,800,000	$225,500,000	+ 22.2	100.00	100.00
Miscellaneous	87	62	+ 40.1							
Total	397,190	319,652	+ 24.2							

Four Months

	1936	1935	Per Cent Change	Per Cent of Total 1936	Per Cent of Total 1935	1936	1935	Per Cent Change	Per Cent of Total 1936	Per Cent of Total 1935
Chevrolet, Ford and Plymou'h	716,158	627,710	+ 14.1	65.65	70.69	$431,800,000	$398,200,000	+ 8.5	57.27	63.85
Others under $750	151,364	120,526	+ 25.8	13.88	13.57	109,200,000	86,600,000	+ 26.0	14.49	13.89
$751-$1000	170,228	112,375	+ 51.5	15.61	12.65	141,700,000	95,200,000	+ 48.8	18.80	15.27
$1001-$1500	45,359	19,245	+136.0	4.16	2.17	52,000,000	23,300,000	+123.5	6.90	3.74
$1501-$2000	3,506	3,931	− 10.9	.32	.44	6,100,000	6,500,000	− 6.1	.81	1.04
$2001-$3000	2,539	2,780	− 8.6	.23	.31	6,600,000	7,600,000	− 13.1	.88	1.22
$3001 and over	1,622	1,497	+ 8.5	.15	.17	6,400,000	6,200,000	+ 3.1	.85	.99
Total	1,090,776	888,064	+ 23.0	100.00	100.00	$753,800,000	$623,600,000	+ 21.0	100.00	100.00
Miscellaneous	136	315	− 56.8							
Total	1,090,912	888,379	+ 23.0							

May

	1936	1935	Per Cent Change	Per Cent of Total 1936	Per Cent of Total 1935	1936	1935	Per Cent Change	Per Cent of Total 1936	Per Cent of Total 1935
Chevrolet, Ford and Plymouth	250,444	196,389	+ 27.3	63.96	66.99	$151,200,000	$116,900,000	+ 29.5	55.77	58.51
Others under $750	57,944	44,317	+ 31.0	14.81	15.12	41,700,000	31,500,000	+ 32.4	15.38	15.77
$751-$1000	64,753	40,737	+ 59.0	16.54	13.90	53,900,000	34,500,000	+ 56.0	19.88	17.27
$1001-$1500	15,815	10,027	+ 58.0	4.04	3.42	18,100,000	11,800,000	+ 53.3	6.68	5.91
$1501-$2000	1,230	275	+347.5	.31	.09	2,100,000	500,000	+320.0	.77	.25
$2001-$3000	877	941	− 6.9	.22	.32	2,200,000	2,600,000	− 15.4	.81	1.29
$3001 and over	479	463	+ 3.4	.12	.16	1,900,000	2,000,000	− 5.0	.71	1.00
Total	391,542	293,149	+ 33.6	100.00	100.00	$271,100,000	$199,800,000	+ 35.9	100.00	100.00
Miscellaneous	1,208	52	+132.0							
Total	392,750	293,201	+ 34.0							

Five Months

	1936	1935	Per Cent Change	Per Cent of Total 1936	Per Cent of Total 1935	1936	1935	Per Cent Change	Per Cent of Total 1936	Per Cent of Total 1935
Chevrolet, Ford and Plymouth	966,602	824,099	+ 17.3	65.22	69.77	$583,000,000	$515,100,000	+ 13.1	56.88	62.56
Others under $750	209,308	164,843	+ 27.0	14.13	13.96	150,900,000	118,100,000	+ 27.8	14.72	14.34
$751-1000	234,981	153,112	+ 53.6	15.82	12.95	195,600,000	129,700,000	+ 51.0	19.09	15.75
$1001-$1500	61,174	29,272	+109.0	4.13	2.48	70,100,000	35,100,000	+100.0	6.84	4.26
$1501-$2000	4,736	4,206	+ 12.8	.32	.36	8,200,000	7,000,000	+ 17.1	.80	.85
$2001-$3000	3,416	3,721	− 8.2	.24	.31	8,800,000	10,200,000	− 13.8	.86	1.24
$3001 and over	2,101	1,960	+ 7.1	.14	.17	8,300,000	8,200,000	+ 1.1	.81	1.00
Total	1,482,318	1,181,213	+ 25.2	100.00	100.00	$1,024,900,000	$823,400,000	+ 24.6	100.00	100.00
Miscellaneous	1,344	367	+266.5							
Total	1,483,662	1,181,580	+ 25.7							

* All calculations are based on list price F.O.B. factory of the five-passenger, four-door sedan in conjunction with actual new car registrations of each model. The total dollar volume for the different models is then consolidated by price classes.

Colors at Paris

Show Reveals Color Trends Most Likely for 1937 Models

Although black remained well in the lead as an individual color, a popular trend toward lighter tones was noted at the Concours d'Elegance Automobile at the Bois de Boulogne, Paris, June 25, according to a report from P. H. Chase of the Paris office of E. I. du Pont de Nemours & Co. Most of the cars were in medium or light hues, in some cases there being several shades of one basic color.

Of the 72 cars exhibited, popularity of colors shown ranked in the following order: Black, 21; ivory, 11; blue, 10; maroon, 8; green, 6; yellow, 4; red and beige, 3 each; and brown, gray and white, 2 each.

There were unusual examples of distributing color in novel and ornamental ways. Colored fenders are still popular, generally being finished in the same color as the car. One unusual adaptation of color was in a duotone scheme. The car which was awarded the "Grand Prix d'Honneur" had front fenders in grass green, the color of the forepart of the car, and rear fenders in black, the color used on the body and top of the hood. Moldings and stripes were practically non-existent, while chromium plating was found on very few exhibits.

The cars exhibited offered no suggestion for a change in the present streamlining popularity and, also, there was no accentuation of this principle. A majority of the cars were upholstered in leather, or lacquered fabrics, a fact due partly to the preponderance of convertible body types, but indicating a steady progress in France toward this type of upholstery.

Rim Output Shows Biggest Increase in Smaller Sizes

During June, 1,518,758 drop center rims, of which 1,081,339 were 16 in. or under and 437,419 were 17 in. or over, were inspected by the Tire and Rim Association, Inc. This compares with 655,183 and 466,490 respectively in the two groups last year. Out of the total rim production (including trucks) delivered in June this year, 57.6 per cent were 16 in. or under and 23.3 per cent were 17 in. or over. During the same month last year, 45.9 per cent fell in the smaller group and 32.7 per cent fell in the larger group. In addition there were a small number of flat base and high-pressure rims.

For the first six months, 6,679,299 drop center rims 16 in. or under were inspected this year, compared with 5,714,781 last year. In the group 17 in. and over, 2,285,514 were inspected this year, compared with 2,359,712 a year ago.

A total of 340,901 truck rims were inspected during June, compared with 280,037 in June, 1935, and for the first

six months 1,978,806 were delivered, compared with 1,923,614 during the same period a year ago.

During the six months' period, 104,586 drop center tractor rims and 631 airplane rims were turned out, compared with 57,115 and 2063 respectively in 1935.

Triumph Announces 1937 Line; First in England

In the absence of any agreement this year among British car manufacturers as to the earliest date upon which the full range of next year's models shall be announced, the Triumph Motor Co. issued on July 7 full particulars and prices of all 1937 Triumph cars. For three years past a date near mid-August has been agreed the earliest for full range announcements and it was not expected that any maker would take advantage of the lack of agreement this year to be so early in the field as in 1932, when several firms announced their 1933 programs in July.

Licenses for Aircraft And Pilots Show Gain

There were 15,204 pilots and 7403 aircraft holding active Department of Commerce licenses on July 1, 1936, according to an announcement by the Bureau of Air Commerce. This compares with 14,805 pilots and 7371 aircraft licensed as of Jan. 1, 1936, and 14,806 pilots and 7205 planes as of July 1 a year ago.

In addition to these totals the department has record of 1764 unlicensed planes (bearing identification numbers only), 406 gliders and 136 glider pilots.

Chicago's compulsory inspection law is now in effect. At this Grant Park lane, about 60 per cent of all comers are found wanting in some respect

The largest gain in number of pilots was in the private flying group, which increased from 5961 at the beginning of the year to 6417 on July 1. A gain of 15 pilots was shown for the amateur group, and there was a slight decrease in the commercial and transport classifications. Out of the total number of licensed pilots, 418 are women, and 70 of these hold transport licenses.

U. S. Rubber Offers New Accessory Line

A new line of automotive accessories has been announced by United States Rubber Products, Inc. An all-season hydraulic brake fluid with an unusually wide operating range and a white rubber tire coating are expected to be the leaders. In addition, the new products include battery cables, radiator hose and a full line of automotive paints and chemicals.

Final Registration Figures Vary 0.2% from Estimates

Total motor vehicle registrations in the United States during 1935 amounted to 26,221,052, according to final estimates of the Bureau of Public Roads, Department of Agriculture. This compares with AUTOMOTIVE INDUSTRIES estimate of 26,167,107 which appeared in the annual statistical issue, Feb. 22. The difference is 0.2 per cent. The increase over 1934 amounted to approximately 5 per cent.

The bureau also reports revenue from state registration and miscellaneous fees of $322,776,536 for the year 1935.

Firestone to Sell Gar Wood Heaters

The Firestone Tire and Rubber Co., auto supply department, has just purchased several thousand Gar Wood Aroflo steam units for car heaters. This new Gar Wood product is adaptable to all present Ford V-8 cars and those manufactured since 1932. Firestone will sell the unit nationally through its super-service stations.

Retail Financing Continues Gain

May Volume Is 63% Ahead of '35; Wholesale Is Up 37%; Five Months' Total for Both Classes Is High

Retail financing for May totaled $184,574,506 showing an increase of 63 per cent over May a year ago and an increase of two per cent over April, 1936, according to estimates of the Bureau of the Census, Department of Commerce. The average amount financed per new car increased from $552 in May, 1935, to $579 in May this year, and the average amount per used car from $231 to $253.

The wholesale dollar volume for May amounted to $185,123,097, an increase of 37 per cent compared with the same month a year ago, and a decrease of five per cent over the previous month.

For the first five months' period, retail financing dollar volume showed an increase of 52 per cent over 1935, while the wholesale figure for the period was up 19 per cent.

	Wholesale Financing Volume in Dollars	RETAIL FINANCING											
		TOTAL			NEW CARS			USED CARS			UNCLASSIFIED		
		Number of Cars	Total Amount	Per Car	Number of Cars	Total Amount	Per Car	Number of Cars	Total Amount	Per Car	Number of Cars	Total Amount	Per Car
May 1936	$185,123,097	460,876	$184,574,506	$400	207,525	$120,193,471	$579	250,288	$63,329,668	$253	3,013	$1,051,367	$349
April 1936	194,323,329	446,956	180,926,890	405	209,307	119,894,021	573	234,766	60,052,639	256	2,883	980,230	340
May 1935	135,510,277	312,186	113,601,251	364	127,201	70,175,835	552	179,462	41,462,893	231	5,523	1,962,523	355
5 Months 1936	778,331,934	1,760,612	701,309,082	398	791,393	453,103,982	573	958,023	244,364,125	255	11,196	3,840,925	343
5 Months 1935	652,519,191	1,249,800	461,320,613	369	538,816	291,357,666	541	687,551	161,490,447	235	23,433	8,472,500	362

Fred J. Lamborn (right) is informed of his promotion to vice-president in charge of manufacturing, by Wm. J. O'Neil, general manager of the Dodge division of Chrysler Corp.

Output Steady Despite Odds

(*Continued from page 71*)

had a particularly successful half year, is already winding up its current model production and has begun retooling for 1937 models. Dealers of this line are bound to experience a shortage of new cars for a few weeks before the new models are announced. A number of other plants will follow early in August, some of the biggest producers, however, expect to maintain output at a high rate with only two or three weeks shut down for changing over. Sales of used cars continue to rise and the ratio of stocks to sales is lower than it has been for several months.

May Exports Up

Exports of automotive products from the United States during May were valued at $23,495,164 compared with $23,947,444 in April and $19,338,159 in May, 1935, according to the Automotive-Aeronautics Trade Division, Department of Commerce.

May shipments abroad of passenger cars amounted to 17,570 units, valued at $9,576,502, compared with 17,583 units, valued at $10,152,605, in Apri and 13,503 units, valued at $7,990,134, in May, 1935. Australia was the chief country of destination for passenger cars during the month under review displacing the Union of South Africa which dropped to second place, followed by Canada, Belgium, Sweden and Argentina.

Truck exports during May numbered 10,806 units, valued at $5,383,814, compared with 8,258 units, valued at $4,-264,983, in April and 6,235 units, valued at $3,308,371, in May, 1935. Australia retained its position as the leading purchaser of American trucks, with Japan, Union of South Africa, British India and Brazil following. In connection with May truck exports, improvement was general in all weight classifications, and especially in the "1-ton and not over 1½ tons" and "bus chassis" groups.

Specifications of the Ace Models Isotta Fraschini Airplane Engines

MODEL	750 RC. 35	XI RC. 45	XI R	750 R	750 X	Caccia
Cylinder Data:						
Arrangement	W	V	V	W	W	V
Cooling medium	Liq.	Liq.	Liq.	Liq.	Liq.	Liq.
No. of cylinders	18	12	12	18	18	12
Bore (inches)	5.52	5.75	5.75	5.52	5.52	4.92
Stroke (inches)	6.69	6.50	6.50	6.69	6.69	5.52
Total Displacement (cu. ins.)	2870	1990	1990	2870	2870	1260
Compression ratio — to 1	5.7	6.4	6.7	5.7	5.7	5.7
B. M. E. P. at rated HP. (lbs. per sq. in.)	156	142	144	127.8	136.5	113.9
Blower Ratio	11.5	10.7				
Cylinder material			Stamped Steel			
No. of valves per cylinder	4	4	4	4	4	4
Intake	2	2	2	2	2	2
Exhaust	2	2	2	2	2	2
Valve location	I	I	I	I	I	I
Mfrs. rated HP. at specified R.P.M	853–1800	814–2250	840–2250	850–1860	880–1750	440–2400
Propeller drive	G	G	G	G	D	D
Consumption:						
Gasoline (lbs. per HP. hour)	.60	.60	.47	.51	.51	.52
Oil (lbs. per hour)	.026	.022	.015	.026	.023	.033
Weight without hub or starter, dry (lbs.)	1690	1350	1330	1620	1510	840
Carburetors, number and make	6–Own	4–Own	4–Own	6–Own	6–Str.	4–Zen.
Installation dimensions (inches):						
Length	86.39	83.23	83.59	86.47	86.47	69.98
Height	47.43	40.15	40.15	41.94	41.94	31.57
Width	40.55	33.07	33.07	40.55	40.78	29.68
Center to center of engine bearers (ins.)	20.47	20.47	20.47	20.47	15.12	14.95

W—Three banks of cylinders. Liq.—Liquid. I—In head. G—Gear. D—Direct.
Str.—Stromberg. V—Vee Type. Zen—Zenith.

Dodge, Plymouth Sponsor Analyzer

Dodge division of Chrysler Corp. advised AUTOMOTIVE INDUSTRIES this week that Dodge and Plymouth dealers are being offered a new motor-analyzer equipment recently developed. The analyzer consists of a number of independent testing units mounted on a stand and is designed to cover a wide range of electrical and mechanical tests of engine elements.

This equipment gives all readings in terms of "go" and "no go" for each test, thus producing uniform results within a predetermined degree of accuracy. Operation of the analyzer requires no special skill; it can be handled by an average mechanic in the establishment.

This motor analyzer equipment was developed by Joseph Weidenhoff, Inc., to standards established by Dodge.

N. O. GILBERT has joined the field sales staff of Studebaker and will be district manager of the Kansas City branch. Mr. Gilbert has been experienced in automobile selling for the past 25 years.

G. S. WELLMAN has been appointed publicity manager of the National Standard Parts Association filling the post made vacant by the resignation of H. J. Moore. Mr. Wellman, who is connected with McDaniel, Fisher and Spellman, Akron advertising agency, was formerly sales promotion manager of the Simmons Mfg. Co., Cleveland.

J. W. TRUITT, executive manager of the India Division of the Chrysler Corp., Export Division, has just returned to Detroit after a five-month trip to India and Burma.

A. W. L. GILPIN, for 25 years in sales positions with General Motors and Ford, has entered the insurance business in Detroit with William L. Graham. The new firm will be known as Gilpin & Graham, Inc., and has offices in the National Bank Building.

THOMAS BRADLEY, who has been vice-president in charge of manufacturing and purchasing of the Hupp Motor Car Co., has been elected executive vice-president at a meeting of the board of directors.

CHESTER J. ROBERTS has been appointed manager of the Milwaukee branch of the Four Wheel Drive Auto Co. Mr. Roberts has been with the company since March, 1935, and for the previous six years was manager of the industries and trade promotion divisions of the Milwaukee Association of Commerce.

JOHN C. FELLI was made assistant treasurer of General Motors Corp. at a meeting of the finance committee this week. Mr. Felli joined the corporation's financial staff in 1923, transferred to General Aviation Corp. as treasurer in 1931, and in 1933 became treasurer of North American Aviation, Inc., in which company General Motors owns a substantial share. Mr. Felli has resigned this position in order to take up his new work.

17 Years of Retail Sales

Estimates for New and Used Vehicles, with Percentage Sold on Installment, Made by NASFC

Estimates of all retail sales of cars and trucks, both new and used, and the percentage sold on installment during the past 17 years, have been prepared by the National Association of Sales Finance Companies and published in *Time-Sales Financing*. Until 1925 inclusive the figures for "New Cars Sold" are based on production, less exports, plus imports. Since then, registrations of new cars, trucks and buses have been taken as representing more accurately retail sales.

The figures on "Used Cars Sold" are derived from new car sales figures by application of the percentages reported by large numbers of automobile dealers. The N. A. S. F. C. table follows:

Estimated U. S. Retail Sales of All Cars and Trucks

Year	Thousands of Vehicles						Per Cent Sold on Instalments			Used Sold % of New
	Total Sold			Sold on Instalments						
	New	Used	All	New	Used	All	New	Used	All	
1919	1,851	1,087	2,938	1,201	484	1,685	64.9	44.5	57.3	58.7
1920	2,057	1,337	3,394	1,267	636	1,903	61.6	47.6	56.1	65.0
1921	1,553	1,093	2,646	992	554	1,546	63.9	50.7	58.4	70.4
1922	2,414	1,663	4,077	1,538	858	2,396	63.7	51.6	58.8	68.9
1923	3,798	2,598	6,396	2,469	1,434	3,903	65.0	54.8	61.0	68.3
1924	3,312	3,021	6,333	2,332	1,734	4,066	70.4	57.4	64.2	91.2
1925	3,569	3,526	7,095	2,434	2,214	4,648	68.2	62.8	65.5	98.8
1926	3,614	3,231	6,845	2,331	2,107	4,438	64.5	65.2	64.8	89.4
1927	2,951	3,497	6,448	1,712	2,224	3,936	58.0	63.6	61.0	118.5
1928	3,481	4,073	7,554	2,022	2,476	4,498	58.1	60.8	59.5	117.0
1929	4,407	5,350	9,757	2,684	3,461	6,145	60.9	64.7	63.0	121.4
1930	3,036	4,654	7,690	1,855	3,006	4,861	61.1	64.6	63.2	153.3
1931	2,222	3,791	6,013	1,395	2,290	3,685	62.8	60.4	61.3	170.6
1932	1,277	2,374	3,651	697	1,116	1,813	54.6	47.0	49.7	185.9
1933	1,740	3,097	4,837	988	1,759	2,747	56.8	56.8	56.8	178.0
1934	2,293	3,671	5,964	1,247	2,126	3,373	54.4	57.9	56.6	160.1
1935	3,255	5,136	8,391	1,888	3,215	5,103	58.0	62.6	60.8	157.8

They're Sitting Down Again!

(*Continued from page 72*)

culties in obtaining satisfactory volume from the Akron plants. It is likewise a fact that plans are progressing and that current conditions made it appear that these plans will have to be pushed to early conclusion. However, these moves are not designed to strike at the union but to insure the company's ability to fill customer orders. In due course proper legal steps will be taken by Goodyear in connection with the labor board's charges."

Sears Contract Terminated

P. W. Litchfield, president of Goodyear Tire and Rubber Company, announced today that the contract under which Goodyear has manufactured special brand tires for Sears, Roebuck since 1926 had been terminated. The contract normally would have expired in 1942 but owing to the enactment of the Robinson-Patman law which became effective June 19, 1936, the terms of which are such that Goodyear was unable to fulfill the requirements of the contract, no sales have been made thereunder since the new law's enactment. Sears requirements under the contract accounted for approximately 6 per cent of Goodyear's annual business. Sears tires were made to their specifications on a cost-plus basis. The termination of the contract does not affect Goodyear's appeal of the Federal Trade Commission's cease and desist order issued against it on account of the Sears contract on March 5, 1936.

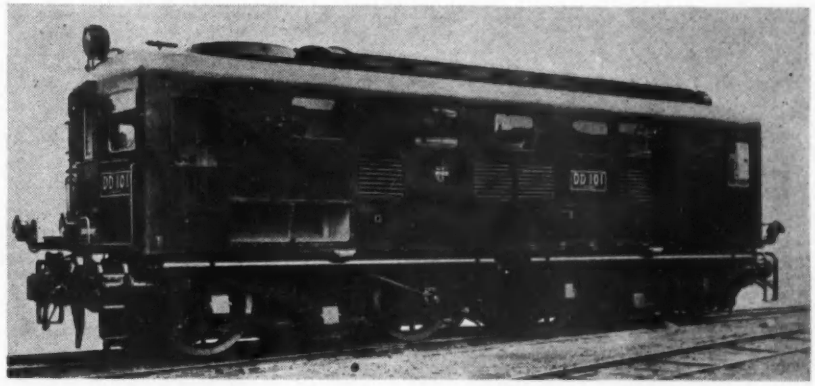
Corporate-Income Tax May Extend Employee Profit-Share Plans

An increase in employee profit-sharing plans may be one of the important consequences of the new Federal tax law applying a graduated levy on undistributed corporation net income. It is understood that a number of large employers are exploring the possibilities in this direction and that the adoption of such compensation plans is not improbable. A double opportunity is seen in such plans since they will minimize taxes and at the same time give the workers a direct interest in the corporation's net profits. The latter point, many students of labor relations believe, is going to be of increasing importance in the future.

Ford Starts New Power House Equipment at the Rouge Plant

Spinning a Ford V-8 steering wheel, Henry Ford at 10.13 A. M., July 15, started the steam flowing through a new turbine generator that makes the giant power house of the Rouge plant the largest high pressure steam generating installation in the world.

The new equipment, which includes a 1400 lb. pressure boiler, increases generating capacity from 200,000 to 326,000 lb. The installation is the first in the world to use all welded pipe. Increased power demands resulting from the company's $37,000,000 expansion and modernization program at the Rouge plant made necessary the additional power capacity. The new generating equipment represents an investment of about $4,600,000.



The first Japanese-built Diesel-electric locomotive (only injection equipment and roller bearings imported) will soon go into service in that country. The engine, made by the Niigata Iron Works, has eight vertical cylinders of 250 mm. bore and 290 mm. stroke (9.85 in. x 11.42 in.), with a rated maximum hp. of 600 at 900 r.p.m. It is direct-connected to the main generator and an auxiliary generator, the former serving as a starting motor for the Diesel by drawing current from the battery, the latter being charged by the auxiliary generator.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

The business outlook has been greatly impaired by the drought and high temperatures over a large section of the country. Devastation from drought and insect pests has affected 27 States, and in five of these the crops have been burned beyond hope of recovery. In the remainder only rain in large quantities can save the crops and cattle. It is reported that 200,000 families are in need of immediate aid. In the last few days rain has fallen in some States, but it is too early to determine the final outcome of the crops. The drought and insect pests caused sharp advances in agricultural prices.

Reports indicate that the high temperatures had the effect of stimulating retail sales of summer goods last week, and wholesale business was from 20 to 25 per cent above the level in the corresponding period a year ago. However, there was a moderate recession in general business, which was mostly the result of a decline in the output of electricity, a substantial reduction in steel operations, and a slackening in several other lines.

Carloading Well over '35

Railway freight loadings during the week ended July 4 totaled 649,759 cars, which marks a decline of 63.880 cars below those in the preceding week, a gain of 178,633 cars above those a year ago, and an increase of 129,018 cars above those two years ago.

Food Highest since '31

Retail food prices rose by 2.1 per cent during the two weeks ended June 16, according to the Bureau of Labor Statistics. This increase brings food prices to the highest level since April, 1931. The current index stands at 83.8, as against 82.1 two weeks earlier and 81.5 a year ago.

Lumber Output at 71 Per Cent

Production of lumber during the week ended June 27 was 71 per cent of the 1929 weekly average. Production was 0.2 per cent below that in the preceding week; shipments were 10 per cent higher, and new orders showed a decline of 6 per cent.

Fisher's Index Gains

Professor Fisher's index of wholesale commodity prices for the week ended July 8 showed a decline of against 83.1 the week before and 82.6 two weeks before.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended July 11 stood at 83.8, as $1,000,000 in holdings of discounted bills. Bills bought in the open market and government securities remained unchanged. Money in circulation declined $8,000,000, and the monetary gold stock increased $10,000,000.

Chrysler Reports Increased Sales in European Division

W. Ledyard Mitchell, vice-president of the Chrysler Corp. in charge of international sales, has just returned to Detroit following conferences with distributors of Chrysler motor products in England, France, Belgium and Holland.

Upon his return, Mr. Mitchell said that he was particularly impressed with the continued vigor of the European market. Chrysler sales of cars and trucks in the European division for six months of 1936 are 13.45 per cent greater than during the corresponding period of the previous year, he said. over the same period are 41.26 per cent Sales of trucks alone in this division higher than last year.

'35 Gasoline Consumption Showed Increase of 6.4%

Gasoline specifically taxed for highway use in 1935 totaled 16,264,012,000 gal., according to latest estimates by the Bureau of Public Roads, Department of Agriculture. This is an increase of 6.4 per cent over the official estimate for 1934 which amounted to 15,292,012,000 gal.

In addition, 811,000,000 gal. were sold during 1935 subject to full tax refund, and 97,586,000 gal. were subject to a partial tax refund, making the grand total, 17,160,339,000 gal.

40 Years Ago

—with the ancestors of AUTOMOTIVE INDUSTRIES

Dr. Carlos C. Booth, a practicing physician of Youngstown, Ohio, has been engaged upon a motor wagon, or cab as he calls it, for over a year past. For several months he has been using this cab in making his professional rounds, having the distinction of being the first physician in the United States to use a motor vehicle in his practice.

The doctor states that he has made a speed of fully 16 miles an hour, climbed hills of 10 to 15 per cent grade at five miles an hour, and through mud two inches deep at 12 miles an hour. The vehicle weighs 1010 lb. and the body is especially designed to hide the means employed to propel it. The motor weighs 130 lb. and is claimed to develop three horse-power. The cylinder is 4 by 6 in., the balance wheel 10 in. in diameter and the speed is 500 r.p.m.

Power is transmitted at slow speed by a cut steel chain running on sprocket wheels and at high speed a 4-in. belt is used in connection with two Bleveney friction clutches, put on or off the high or low speed as desired.—From *The Horseless Age*, July, 1896.

Special Train Used In Rail-Truck Run

Inaugurating its coordinated rail-truck service between Chicago and St. Paul-Minneapolis on July 7, the Chicago Great Western railroad operated a special train of 25 flat cars carrying 50 truck trailers. It was announced that eight of the cars were demanded by Keeshin Motor Express Co., Inc., and that the remainder were needed to accommodate the operators who are members of the Illinois - Minnesota Truck Operators Conference.

The service is to be a nightly feature over the Chicago Great Western road between the two termini and officials expect the daily demand will require 15 to 20 cars.

To meet this competition between the termini points several of the railroads operating over the routes have announced that they will effect cuts in freight charges.

The railroad receives $42.50 for carrying a loaded trailer or truck and $21.25 for carrying them empty.

Accomplishment vs. Utopia

(Continued from page 71)

These factual accomplishments should stand out as highly significant and worthy of the thoughtful study of the American people. The automobile industry's record may be pointed to as one implicit in the system which has given this country prosperity and its high standard of living. It is once again demonstrating the aims of industry to treat fairly and humanely its factory workers.

On July 25th

St. Christopher's Day

Paris motorists attend a special service in the church of St. Christopher.

St. Christopher, according to legend, carried travelers across a bridgeless river as an act of charity. One day, as Christopher staggered under the surprising weight of a child, he was told: "Marvel not, for thou hast borne upon thy back the world and Him who created it." Many centuries ago St. Christopher became the patron saint of all travelers. Devout motorists frequently attach to their dashboards medals of the saint.

The church erected in Paris in honor of St. Christopher contains (upper view) many pictures of modern forms of travel: automobiles, ocean liners, airplanes, motorcycles, racers, skiers, etc.

Above the door (lower left) are the words: "Look upon St. Christpher, and go thy way reassured."

Following the special service, cars file past (lower right) to receive the bishop's benediction.

Wide World photos

• The World on Wheels •

Automotive Metal Markets

Straits Tin Is Up 4 Cents Over July 1 Level; Flat Rolled Steel Rushed to Complete Second Quarter Bookings

By William Crawford Hirsch

An advance of 1⅜c. a pound in the market for Straits tin on Monday, raising the price 4c. a pound over the July 1 level, served to direct the attention of automotive consumers to that metal more than has been the case in a long time. Based on last year's estimate of a consumption of 9000 long tons, a 4c. advance would add approximately $800,000 to automotive consumers' tin bills, but the rate at which tin is being absorbed by automotive users in 1936 is generally estimated to be considerably higher than it was last year.

In 1929, automotive consumption of tin was placed at 21,000 long tons and a 4c. per pound rise would have meant an increase of $1,800,000 in the cost of the metal. These figures do not take into consideration the large amount of solder and white bearing metals that go into radiator and bearings repairs.

The cause for the advance at the opening of this week's market was a sharp rise in London, brought about by the withholding from the market of much Straits tin in the belief that the International Tin Committee would impose more severe restrictions of production quotas. Pending more adequate information and not so certain that this may prove to be merely another speculative flurry, consumers held aloof from commitments for the time being.

Flat rolled steel producers made every effort this week to complete shipments of all orders booked at second quarter prices. Fresh buying at the $2 per ton advance is mostly in small tonnages for nearby requirements.

Pig Iron—With only a few exceptions, melts of automotive foundries are tapering off, and in most cases third-quarter requirements have been fully covered. Prices are unchanged.

Aluminum—Routine conditions prevail in the market for primary as well as secondary metal and alloys. No price changes are noted.

Copper—Somewhat more activity is noted. Producers reported a fractional advance in export prices. The domestic market is unchanged at 9½ cents delivered in Connecticut, with the "outside" market quoted at 9.35 cents.

Tin—Spot Straits tin was quoted on Monday at 44¾ cents, compared with 43⅜ cents at the preceding week's close.

Lead—Storage battery manufacturers of late have restricted their commitments to nearby needs. Part of their July needs remain to be covered. Demand generally, however, is on the uptrend. The price remains at 4.60 @ 4.65 cents, New York.

Zinc—Lessened ore production has given the market a firmer appearance.

Iver J. Cottle

Iver J. Cottle died recently in Detroit, following a long illness. For the past three years Mr. Cottle has been connected with the National Motor Bearing Co., Inc., of Oakland, Calif., serving as a special field engineer in the Detroit area.

More than 400 **floor trucks** as well as **caster and wheel equipment** are illustrated and described in a catalog* recently issued by the Nutting Truck Co., Faribault, Minn.

The following publications have recently been received from the International Tin Research and Development Council, 149 Broadway, New York, N. Y., and are available gratis from that association: "Some Recent Investigations on the **Corrosion of Tin**," by D. J. Macnaughtan and E. S. Hedges. "The **Hot-Tinning of Copper**: the Attack on the Basis Metal and its Effects," by E. J. Daniels. "The Constitution of the **Tin-Rich Antimony-Tin Alloys**," by Prof. D. Hanson and W. T. Pell-Walpole. "Influence of **Surface Cuprous Oxide Inclusions on the Porosity of Hot-Tinned Coatings on Copper**," by W. D. Jones.

Bulletin No. 440* of the Bristol Co. covers the company's new series of Ampliset Free-Vane **Controllers** for time, temperature, flow, liquid level, pressure time pressure and humidity.

A 16-page manual* has been issued by Linderman Devices, Inc. covering the operation, construction, installation and servicing of **Linderman brakes.** There is considerab'e data of interest to those interested in this type brake.

"The Story of the Perfect Octahedron"* is the subject a new pamphlet by the Koebel Diamond Tool Co., Detroit. It points out that several **small diamonds** may do a better job than one big one—and cost a lot less.

"Mesle's **Chord Method for Measuring the Thickness of Metal Coatings,**" by William Blum and Abner Brenner. Research paper No. RP866, available from the National Bureau of Standards, Washington, D. C.

Lewis-Shepard Co., Watertown, Mass., have recently issued a circular* describing **mechanical lifting devices** for unusual or specially adopted jobs. A portable crane for lifting airplane engines into place is an example of the company's specialized products described.

The DeVilbiss Co. has recently announced a new Catalog "DE" covering and supplementing the DeVilbiss **spray painting equipment** featured in catalog "DD." Many additions and changes have been made.

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*Available through AUTOMOTIVE INDUSTRIES.

Eaton Reports Large Gain

The Eaton Mfg. Co. and subsidiaries reported net earnings for the quarter ended June 30 of $751,902 after all charges including provision for taxes. This compares with $436,688 for the second quarter of 1935.

Calendar of Coming Events

SHOWS

Automobile Salon, Oriental Fair, Lwow, Poland .....Sept. 5-15
International Automobile Section, 7th Levant Fair, Bari, Italy .....Sept. 6-21
30th Automobile Salon, Paris, France, Oct. 1-11
Olympia Motor Show, London, England, Oct. 15-24
Czechoslovakia, 26th International Automobile Exposition, Prague....Oct. 16-25
9th International Automobile Salon, Milan, Italy .....November
National Motor Truck Show (N. J. Motor Truck Assn.), Newark, N. J., Nov. 3-7
National Automobile Show, Grand Central Palace, New York .....Nov. 11-18
International Aviation Show, Paris, France .....Nov. 13-29
Boston Automobile Show.....Nov. 14-21
Columbus Automobile Show.....Nov. 14-20
Chicago Automobile Show.....Nov. 14-21
Detroit Automobile Show.....Nov. 14-21
Washington, D. C., Automobile Show, Nov. 14-21
Cincinnati Automobile Show....Nov. 15-21
St. Louis Automobile Show.....Nov. 15-22
Brooklyn Automobile Show.....Nov. 21-28*
Cleveland Automobile Show.....Nov. 21-28
Kansas City Automobile Show..Nov. 21-29*
Milwaukee Automobile Show...Nov. 22-29
Baltimore Automobile Show.Nov. 26-Dec. 5
28th Automobile Salon, Brussels, Belgium .....Nov. 28-Dec. 9
Peoria Automobile Show....Nov. 30-Dec. 5*
Philadelphia Automobile Show, Nov. 30-Dec. 5*
Natl. Exposition of Power & Mechanical Engineering, Biennial Meeting, New York City .....Nov. 30-Dec. 5
Automotive Service Industries Joint Show, Chicago .....Dec. 9-13

CONVENTIONS AND MEETINGS

Mid-Summer Convention of Automotive Trade Association Managers, Montreal, Que. .....July 28-30
National Association Power Engineers, Annual Meeting, Chicago, Aug. 31-Sept. 4
American Chemical Society, Semi-annual Meeting, Pittsburgh, Pa., Sept. 7-12
World Power (Fuel) Conference, Washington, D. C. .....Sept. 7-12
Annual Meeting and Convention of the National Association of Sales Finance Companies, Hot Springs, Va. .....Sept. 14-16
American Transit Association, Convention, White Sulphur Springs, W. Va. .....Sept. 21-24
First Aircraft Production Meeting of the S. A. E., Los Angeles...Oct. 15-17
Annual Meeting of the National Association of Motor Bus Operators, Detroit, Mich. .....Oct. 15-16
American Society for Metals, 18th Nat'l Congress, Cleveland, O.....Oct. 19-23
16th Annual Meeting of the American Welding Society, Cleveland, O., Oct. 19-23
American Gas Association, Annual Meeting, Atlantic City.....Oct. 26-31
American Petroleum Institute, Annual Meeting, Chicago.....Nov. 9-12
National Foreign Trade Convention, Chicago .....Nov. 18-20
Natl. Industrial Traffic League, Annual Meeting, New York City.....Nov. 19-20

CONTESTS

100-Mile National Championship, New York State Fair, Syracuse....Sept. 12
First Annual 400-Mile International Sweepstakes, Roosevelt Raceways, L. I. .....Oct. 12
500-Mile International Sweepstakes, Los Angeles Raceway .....Nov. 29

* Tentative dates.

Just Among Ourselves

Hails Revolution In Tractor Design

THERE were rumors from Missouri, during the worst part of the depression, that tractors on farms were being supplanted by mules who could be fed on crops raised right on the farm and who would, in the course of nature, reduce the amount of fertilizer which must be purchased outside.

A swing-back of farming trends has changed all that. George Krieger of the Ethyl Gasoline Corp., who for the past five years has been studying agricultural conditions in the Middle West, finds that "a mechanical revolution is under way in American agriculture," which, he says, "faces the greatest economic change since the invention of the reaper by Cyrus H. McCormick in 1831."

Six months ago, Mr. Krieger contends, farm tractors were 10 years behind automobiles in engine and fuel development, but today they lead in power and efficiency.

The lonely-furrow plower is content no longer with a hard seat and cleated wheels in his tractor. Self-starters, headlamps, spotlights, rubber tires, multiple-speed transmission, and even radios, are found as standard equipment on current tractor models. In general, he finds, 29 years of tradition in designing, producing and selling tractors are being scrapped, while the automobile and aviation industries are being combed for practice applicable to tractors.

Mr. Krieger is a consistent prophet. Two years ago he was instrumental in reviving the Tractor and Industrial Power Equipment activity of the Society of Automotive Engineers, and became a vice-president of the S.A.E. representing the activity. The activity has been conspicuously successful since its revival and has done a lot to spotlight the necessity for modernizing tractor design.

* * *

Airlanes Put Under Federal Policing

UNDER powers conferred on his office by a statute of 1926, the Secretary of Commerce has officially defined 98 civil airways and made them subject to traffic direction by the Bureau of Air Commerce. The Airways include a strip 25 miles to either side of centerlines connecting the cities they link. The Federal Government will establish traffic-control stations, and do a pretty complete policing job.

* * *

Automobile Co. Dividends Spurt

THE motor-vehicle industry was fifth in the physical size of its dividend distributions for the first six months of this year compared with the first half of last, but the 194 per cent jump which the figures took give the industry one more claim to the undisputed title of "depression, leader out of."

The figures, for which *Business Week* did the spadework, show that the copper industry came second with a 132 per cent increase in its dividends. Public utilities, oils, raids, and the bank-insurance group are all bigger than the automobile industry in their dividend contributions, but the automobile industry leads the manufacturing group on every count.

* * *

Silly Season Gets a Sendoff

THE gentleman whose signature appears on the left hand side of United States notes occupies an office which, on the whole, has presented few opportunities for climbing into the public prints. Perhaps this fact may be cited in extenuation of the fact that last week, when the present occupant of the office, William A. Julian, treasurer of the United States, sailed for a vacation in Europe, he unleashed a tirade against the motor vehicle which could well serve as official opening remarks for what our English friends like to refer to as the "silly season."

Said Treasurer Julian (and we hope we are misquoting him):

"What's wrong with the world today is the internal-combustion engine."

He "explained" as follows: "The nation has been put on wheels. Everything is mobilized. Through the internal-combustion engine, the number of human beings who have been thrown out of employment is beyond the counting.

"What are we going to do about it? Well, all I can say is that we had better keep our heads as best we can."

To the honorable treasurer of the United States, we respectfully suggest the application of his own last sentence to the matter of the foregoing paragraphs.

—*H. H.*

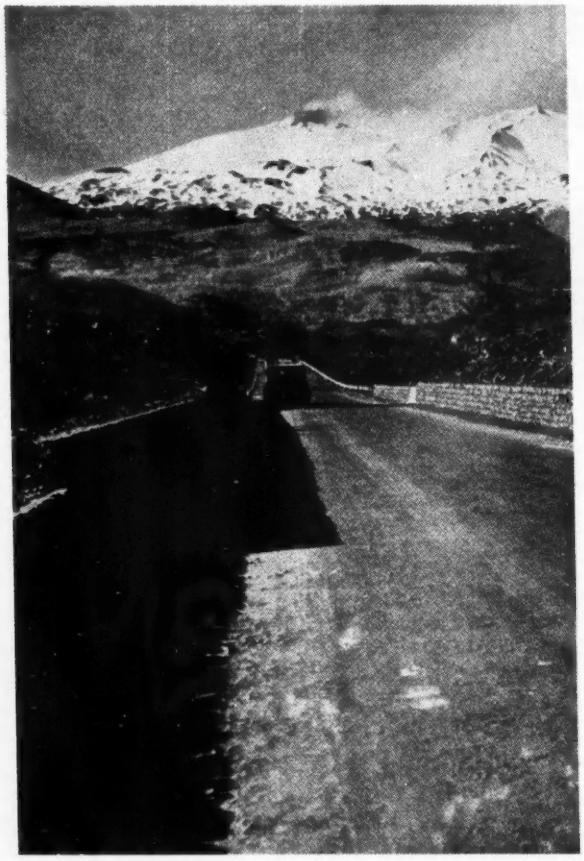


Photo from *Travel in Italy*

A new belt road circles Sicily and joins this highway to Mt. Etna.

"All Roads

WITHIN the past 15 years an amazing change has taken place from one end of the Italian Peninsula to the other. How rapid and how complete the change has been is hard for any one to realize who has not watched it grow from week to week, from year to year. But the record of achievement since the close of the war is impressive.

Road building and industry alike clearly mark this advance, and of all the great roads none is more typical of the new Italy than the Via Aurelia. From Ventimiglia to Genoa it is Italy's vestibule from the French Riviera. Throughout its four hundred-odd miles in length, the Via Aurelia has been wholly remade and conformed to exacting standards, yet for more than 2000 years it had served as a highway for horse-drawn vehicles.

At San Pier d'Arena, Genoa's industrial fringe becomes continuous, and the great steel works of Ansaldo and Ilva, Italy's chief steel producing corporations become apparent. Here the new Camionali or heavy motor truck roads branch off, one fork to Turin and the other to Milan. Completed in 1934, these forty-foot highways without grade crossings are operated by the government. Primarily intended for heavy commercial traffic, these roads are open to ordinary motors on payment of a moderate toll. The Camionali fall into a special category and are not classed as "state roads" as is the Via Aurelia.

Since 1928 all state roads have been under the control of the Azienda Autonoma Statale della Strada, generally called the A.A.S.S. The duty of this central and solely responsible body is the upkeep and remaking of existing roads and the construction of new roads. Its program requires solid, hydraulically sound foundations; smooth, even surfaces; paving suitable to the nature and intensity of the traffic; freedom from surface dust; sufficient width; curves banked at their outer edge, and curve visibility as extensive as possible; correct grading; abolition of grade-crossings; enough cantoniere or road-patrol houses; and perfect upkeep. Bridges and viaducts, appropriate to the roads they carry fall under the same authority, as do also parapets, and tunnels such as those on the roads skirting Lake Garda. Likewise, the A.A.S.S. is planting trees along the sides of the roads, both for the sake of beauty and for shade, the latter to protect asphalt and bituminous macadam surfaces as well as for the comfort of travelers. For paving, the usual materials are employed, varied according to the traffic and other needs of the individual roads repaired or made.

What the A.A.S.S. and its road administration have meant to Italy, only those who have motored the length and breadth of the country for years past can fully understand. Before the War, a few highways had been adapted to motor traffic. Most of them kept the character of horse-vehicle roads till long afterwards—narrow and beset with curves; badly rutted, especially near towns; and the dust insufferable. When it rained, the dust became a sea of greasy mud. Albeit conditions later on got steadily better, and you could sometimes drive five or ten miles at a stretch over comfortable surfaces, the roads in general were nothing to brag about. Until very recently in some districts, during the winter they strewed the surface with breccia, sharp spawls of road metal, in hopes traffic would grind them in and thus simplify spring repairs. A few miles of this would ruin your tires; punctures were inevitable. Local or provincial powers had road jurisdiction; there was no centralized responsibility. Main roads in stretches might be tolerable or even good, in one province; in the next they might be atrociously bad. It all depended upon funds available and the state of official conscience. Not till the A.A.S.S. undertook the present program did the roads become really good.

Along the Via Aurelia, from its official end at the French border to its official beginning in Rome, there's enough to convince you that modern Italy is very much alive. Travels on the other main roads will strengthen this conviction. To revive the Imperial highway scheme has been the express government aim, not for the sake of sentiment but because of its well-conceived utility. To say "All roads lead to Rome" is only another way of saying "All roads lead from Rome." Following the lines of ancient Roman highways, the main roads of Italy today radiate

by Harold Donaldson Eberlein
and Cortland vanDyke Hubbard

Lead to Rome"

—as true under Mussolini as Caesar. A brief account of the A.A.S.S. and its 12,000 miles of modern highways, of private "autostrade," and of FIAT, the nation's number one industry

in all directions from Rome as a center and spread out in an ever-widening network that covers the whole kingdom.

Italy's substantial highway-building achievements reflect credit on the A.A.S.S. When that body began to

A section of the privately-owned "Autostrada"—toll super highway between Turin and Milan.

Photo from *Le Opere del Fascismo*

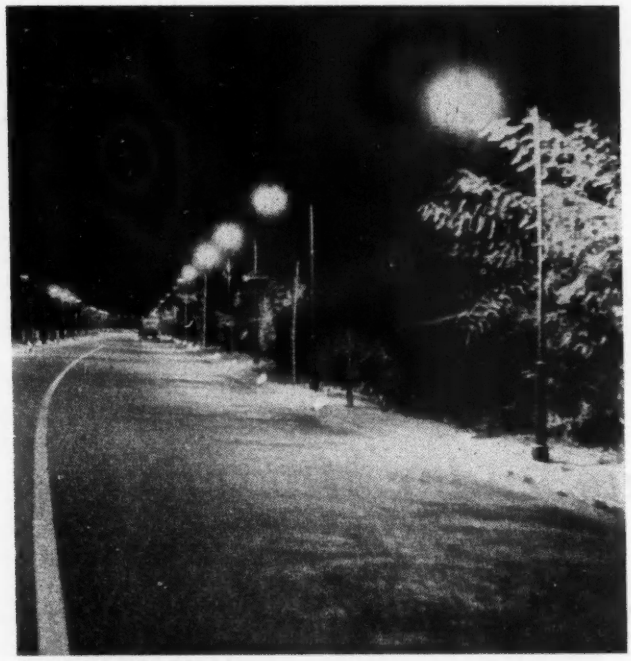


Photo from *Travel in Italy*

This highway, lighted all the way, joins Rome with the sea at Ostia and the Lido of Rome.

function in 1928, Italy had about 12,800 miles of state roads, of which only about 310 miles could be considered fairly creditable. These had been treated, on many stretches, only enough to lay the surface dust. With 137 roads suddenly committed to its care, the A.A.S.S. started its work on the roads out of Rome and on those elsewhere in most urgent need of attention. In the interval between the end of 1928 and the spring of 1936, the road administration could not possibly complete a task of such magnitude as that confronting it; nevertheless, the amount accomplished in that period is astonishing. At the end of June, 1935, instead of 310 miles of creditably surfaced roads, there were over 6000 miles surfaced with bituminous permanent types of improvement and another 6000 with waterbound macadam surface.

To name only a few of the A.A.S.S.'s finished works of new building or of complete reconstruction, there is the new road from Rome to Naples, so that you can now drive to that once ill-paved city without breaking your springs or being smothered with dust. As far as Capua, you can go by the Via Appia, in spite of its modern grooming and reconditioning, still pervaded by the memories of the "Quo vadis" vision, of Sts. Peter and St. Paul; or you can take the Via Latina, equally modern in external form and equally bound to its associations with St. John and the wayfaring episodes of more than two milleniums. There is the new boulevard to Ostia, lighted all the way. There are the new roads around the shores of Lake Garda. And there is the new belt road around Sicily, so that you can now make the circuit of the island and also ascend Mt. Etna on smooth surfaced highways.

Apart from the state roads, which are the definite charge of the road board, there are some 93,000 miles of secondary roads; these, too, through the agency of the A.A.S.S., the government has considerably improved. On all the roads, much labor was done altogether by hand, and labor-saving machinery—stone crushers and the like—rendered as little help as possible, in order to give work to the idle during the acute stage of unemployment. Funds thus spent on relief returned a tangible quid pro quo to the country.

Altogether separate from the system of state and secondary roads, and outside the province of the A.A.S.S., are the autostrade or motor speedways, dear to the hearts of Italian motorists, who love to drive fast. These autostrade, most of which start from Milan, are wide, well-paved straight courses uninterrupted by cross-roads, which are carried either under or over them; there is no speed limit and all horse-drawn vehicles, motor trucks, pedestrians and cyclists are excluded. For their construction the state supplies up to one-third of the cost; the rest private interests subscribe, controlling traffic and charging a toll gaged by the size and type of car. After fifty years, the speedways revert to the state without cost; the private subscribers meanwhile will presumably have reimbursed themselves from toll receipts for the original investment outlay plus appropriate interest.

One autostrada runs from Turin to Milan; from Milan one with branches connects with both Lake Maggiore and Lake Como, and another runs to Bergamo and connects with the cement-paved Bergamo - Brescia speedway. There is also the Padua-Venice speedway connecting with the new viaduct across the lagoons. When all the autostrade planned are completed, there will be a speed line, the Pedemontana or "road at the foot of the mountains" all the way across Northern Italy from Turin to Trieste. The speed road from Florence to Viareggio has already been mentioned and, in the South, there is the fine speedway from Naples to Pompeii, a boon to those who remember that journey in the old days.

Italy's interest in roads is doubtless spurred on by its interest in automo-

The "Via Aurelia" is Italy's coastal highway from Rome to the French Riviera.

Photo from *Le Opere del Fascismo*

biles for every Italian is keen about motor cars. Every item of automobile mechanism and design rivets his attention; details of construction are matters of wide popular interest. Anywhere outside of the large cities, if you leave your car unattended—be it of British, American, French or German make—you're certain to find your hood up, when you come back, and a crowd of boys and young men standing about, intently examining your engine. They're not meddling nor monkeying with the mechanism; they're just looking at it, staring till their eyes almost pop out, and discussing it volubly. They're acutely critical. Mechanical aptitude seems so innate with most of them that you'd expect them to effect any emergency repair with nothing more than a screwdriver, a pocketknife and a shoestring.

Modern Italy's go-ahead spirit is nowhere more in evidence than in the automobile industry. Urge of enterprise gave birth to the greatest automobile establishment in Europe. A coterie of wealthy young motor enthusiasts started it in Turin, in 1889; they called it Fabbrica Italiana Automobili Torino, a name soon shortened to "FIAT" from the four initial letters. (Corporate alphabetic designations did *not* originate in America,) In 1904, on an American track, a Fiat car made the worlds speed record of 91.9 miles per hour. This ensured publicity and popularity.

Before the War, Fiat had become a vigorous concern, but not of amazing size. War activities, and then rapid post-War developments, together made it a gigantic affair. Its factories at Lingotto, on the outskirts of Turin, cover more than seven square miles of working area. On the roof of the largest building is a testing-track about six "lanes" wide and connected by broad spiral ramps to all floors and all parts of the plant. If you like, you can drive in one door, right up to the roof, around the testing-track, down again and leave by another door, without once stirring from your car. Fiat operates its own hydro-electric power-plant, has its own steel and iron foundries, makes its own tools and machinery, and makes practically all its own automobile parts.

Besides making automobiles and other automotive vehicles, Fiat makes railway equipment, rail-motor cars, tractors, Diesel engines and airplane engines. It supplied the engines used in General Balbo's flight to South America. Unsparing in expenditure and efforts towards technical perfection in its engines, and tireless in scientific research and equipment toward that end, Fiat has installed a high-altitude aircraft-engine test-plant as a part of its equipment, the only thing of its kind in existence. In this recent unique addition to the factory, ingeniously contrived by Fiat engineers, all atmospheric conditions that might occur in an imaginary vertical column of air rising from sea-level to an elevation of more than six miles can be artificially reproduced, and the results of engine tests easily followed and recorded.

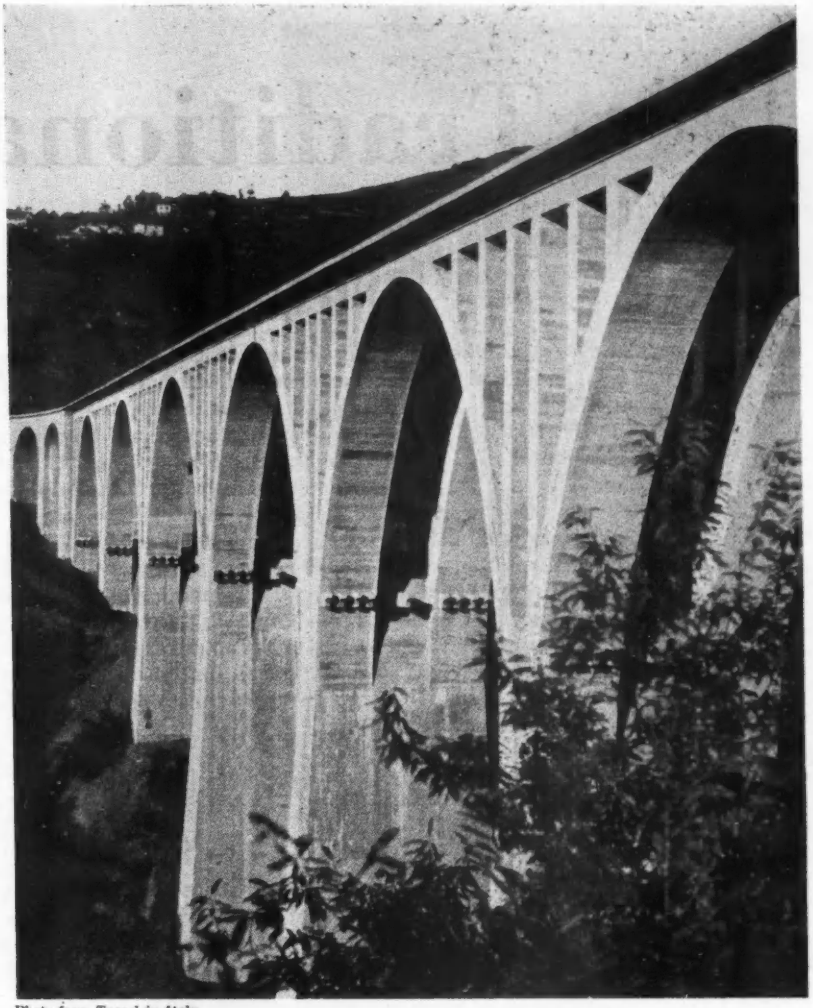


Photo from *Travel in Italy*

A viaduct near Genoa on one of the new "Camionali" —designed expressly for heavy truck traffic.

Fiat's peak production of automobiles was in 1926 when 52,000 were turned out; though the output has been smaller in the subsequent depression years, an imposing number of cars has left the factory and Fiat accounts for 75 to 80 per cent of Italian automobile production. In addition to the several types of cars that bear its own corporate name, Fiat brought the "Balilla" several years ago, a small, low-priced 4-cylinder car of low gasoline consumption, that has rapidly won immense popularity, thanks to the greatly improved roads. The "Balilla" is the "Baby Austin" of Italy.

One of the most progressive corporations with respect to the contentment and happiness of its army of employees, Fiat has its own dopolavoro ("After-work") organization, with ample athletic grounds and a clubhouse in the nearby Italian Alps. For a membership fee of 36 cents a year, the subscriber is entitled to buy tax-free food at the company's restaurant, special railway rates, reduced-rate theater tickets, cheap tickets for other amusements, and expert coaching in all sports. To the employees' general welfare Fiat has also contributed by maintaining vocational schools, mutual aid societies, facilitating insurance plans, establishing cooperative gardens and providing model housing. Fiat, in short, is not only a great manufacturing plant typical of the best industrial spirit and ideals; it is a national institution.

Although there are about twenty-odd factories making motor vehicles, the Lancia and Bianchi works, after the Fiat, account for most of the output, while Alfa Romeo, Bugatti, Itala and Isotta-Fraschini supply either a limited number of smart speed cars or else cars of special requirements. The present

(Turn to page 102, please)

Traditional Methods

ONE of the most important contributions to automotive engineering in recent years — the development of the cast crankshaft— was discussed in complete detail in a paper, "Casting and Machining of Ford V-8 Crankshaft" by W. F. Pioch of the Ford Motor Co., at a recent SAE meeting in Detroit.

Production does not start with the machining of the crankshaft, neither does the molding represent the entire pioneering achievement. The manufacturing development begins with the patterns: or the more proper name would be "core boxes," as the entire mold is made of dry baked sand.

There are 16 core boxes necessary to make up the stack-mold of the 16 layers. Each core box is an individual unit of development. The bottom box, or No. 1 box, contains the shapes of four pulley fit diameters, which do not lie in the normal plane of the crankshaft centerline, but in an offset position. This will be explained in just a moment. The extreme front end of the crankshaft is offset 0.189 in. from the centerline in one direction and shifted 0.105 in. from the centerline at 90 deg. to the 0.189 in. shift. The centerline of the portion of the crankshaft pattern in this box is placed on an angle to the normal bearing centerline, the angle being 1 deg. 17 min. in a plane leaning toward the 0.189 in. offset, and 0 deg. 44 min. in a plane toward the 0.105 in. offset.

This offset continues in No. 2 box, the angles remaining the same, but the offset lessened, due to being nearer the converging point of the angles.

A typical analysis of the metal used for crankshaft castings is given below:

Chromium	.40 to .50
Silicon	.85 to 1.10
Manganese	.60 to .80
Carbon	1.35 to 1.60
Copper	1.50 to 2.00
Phosphorus	.10 Maximum
Sulphur	.06 Maximum

It takes about 3½ hours from the moment the furnace receives a cold charge to the time pouring can begin.

The metal leaves the furnace at 2800 deg. Fahr. and the pouring temperature is 2700 deg. Fahr. A drop in temperature of 30 deg. Fahr. is permitted, thus establishing a pouring range of 2670 deg. Fahr. to 2700 deg. Fahr.

The pouring weight of each mold for the (4) crankshafts, including the gates and risers, usually runs about 430 lb. The equipment will take care of a daily production of about 6500 crankshafts, and at the weight just given per mold, 110,000 lb. of melted metal must be taken from the furnaces daily; in other words, in excess of 50 tons.

The shafts are now ready for the first individual operation, that of normalizing and heat treating, or the process of relieving internal strains and brittleness. Next the shafts are heat treated to obtain the desired physical properties, which are as follows:

Torsion tests on shaft:

Elastic Limit, Lb. Per Sq. In.	88,200—96,500	
Ultimate, Lb. Per. Sq. In.	128,000—130,000	
Twist at Elastic Limit	9 Deg.	6 Deg.
Twist at Ultimate Limit	16 Deg.	25 Deg.
Brinell Hardness	255	321

Shows four crankshafts after casting, with the "gate" broken up and the four individual crankshaft castings, the central basin and sprue and the five risers.

Shafts at normal atmospheric temperature are placed in a double-deck furnace and brought up to a temperature of 1650 deg. Fahr. in one hour. Shafts are held at this temperature for 20 minutes then reduced to 1000 deg. Fahr. in air, then brought up to 1400 deg. Fahr. in one hour, held at 1400 deg. Fahr. for one hour and discharged from the furnace at 1000 deg. Fahr.

Due to the fact that the Ford V-8 crankshaft is made as a special alloy casting instead of the conventional drop-forging, many traditional machining methods have been altered to conform to the different conditions encountered. Cutting speeds and feeds have been most widely affected.

A milling cutter, fed by a contour

Discarded

by Ford in the manufacture of cast alloy crankshafts for the V-8

Shows the "gate" of four crankshafts after being shaken out of the mold, showing also the central basin and sprue and the risers.

cam, removes excessive stock which might remain when gates and risers do not break evenly from the casting. A high speed inserted blade cutter is used, cutting speed being 47 in.

Machine operations begin with the centering of both ends of the crankshaft. The shaft is positioned for centering by locating on the large counterweights. The shaft rests on four points, two of which are rigid. The other two points rest on a rocker arm and tend to create a three-point bearing condition. By locating the crank in this manner, centers are placed in a plane parallel to the centerline of crankshaft, but on the centerline of the unmachined mass.

The next, a partial operation, checks the accuracy of the centering operation, with a rough static balance test, from the centers.

Locating on the centers, the center main bearing is rough ground to establish a steady rest surface for use on succeeding operations. A 24-in. diameter by 17/16 in. wide wheel is used.

The next operation is to rough turn O. D. of flange and followed by rough turning fan pulley diameter. The parts are hydraulically clamped and the tools hydraulically fed into work. We rough turn the diameters and lengths of the three main bearings, this also being done on hydraulically operated machines. 0.75 x 0.75 high speed tools are used and the cutting speed is 40 ft. per min.

An automatic lathe faces the flange and turns the oil slinger grooves, using high speed tools at 38 ft. per min.

At this time, we re-center and counterbore the flange end of the crank, this operation becoming necessary due to having removed the greater part of the center hole when facing the flange. The operation is done at present on a single spindle vertical drill; however, we have under construction a rotary type continuous machine.

The crank is now placed in a two-way automatic machine which drills, reams, countersinks, and taps four 7/16-in. diameter holes and reams two 7/16-in. holes in flange. At the same time, the machine drills, reams, countersinks, and taps one ⅝-in. diameter hole in front end of crank and faces small end to length, using high speed steel at 24 ft. per min. for facing.

Next, we grind rear main bearing to length. This is done at this time to establish a master face, from which the spacing of succeeding operations are determined. The wheel is 20 in. diameter by 2¼ in. by 12 in.

The four pin bearings are turned at one time on an automatic crank lathe, the crank being clamped and the tools fed hydraulically.

Oil holes are drilled from one bearing to another, with the crank held in an angular position, the average length of drilled hole being about 4.5 to 5 in. and 3/16 in. diameter. The drill presses used have hydraulically fed heads equipped with over-load releases. This release not only ejects the chips when the drill becomes chip-bound, but also detects dull drills, and therefore, to a large extent, eliminates drill breakage. High speed drills are used at 35 surface feet.

Pin bearings are grooved to width, semi-finish turned on the diameter and then inspected. High speed steel form tools are used at 20 surface feet.

The oil holes are countersunk to remove any burrs, and the crank is now ready for the major grinding operations.

The pin bearings are finish ground on hydraulically operated grinders, using 42-in. diameter wheels and holding dimensions to within 0.001 on the diameter and within 0.002 on the width. The surface speed on the wheels is ac-

curately maintained as wear occurs, by changing the motor speed proportionately. A 36-in. dia. x 2-in. x 12-in. wheel is used.

The flange diameter is finish turned and chamfered, and end of the shaft chamfered. High speed steel blades are used at 33 ft. per minute, removing 0.03 stock.

The three main bearings are finish ground for diameter and length, the order of operations being: center, rear, and front, the center main bearing being ground first as a steady rest surface for the succeeding operations. A 24-in. dia. x 1 49/64-in. x 12-in. wheel is used, 0.025 stock being removed.

The O.D. of flange, the gear fit diameter, and the fan pulley diameter are finish ground in separate operations in sequence named. This also uses a 24-in. dia. x 1 49/64-in. x 12-in. wheel.

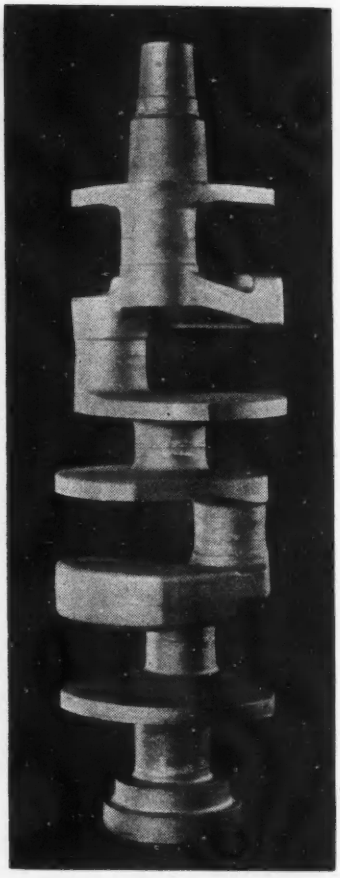
A rotary type continuous automatic mill cuts the keyway in the gear fit diameter, the keyway being held within 0.001 in relation to the centerline of the bearings. A high speed steel multi-blade cutter is used at 38 ft. per min.

The thrust face of the rear main bearing is polished, using a felt wheel. The surface of the wheel or polishing face, has been impregnated with a fine grain (passing through 180-mesh) especially prepared abrasive compound. This is not a sizing operation, but a means of obtaining a highly polished surface to a previously closely machined dimension.

The fly-wheel flange face is ground, the corners of all drilled or machined surfaces are checked for burrs, and the crank is hung on a mono-rail conveyor to be carried through an automatic steam and hot water washer. A 20-in. dia. x 1.5-in. x 12-in. wheel is used to grind flange faces.

After regaining a normal temperature of 68 deg. to 70 deg. Fahr. the shafts are rigidly inspected 100 per cent. The concentricity and alignment of all bearings must be within 0.001 limit.

Machining operations having been completed and crankshaft having undergone rigid dimensional inspection, we are now ready to subject the crank to a unique, but basically simple, static and dynamic balance test.



Shows the crankshaft after casting and before machining, but after the shaft has been cleaned by sand blasting.

The crankshaft is dynamically balanced within (.2) two tenths inch ounces at any one point of reference.

The crank pin balancing weights, commonly called "bob" weights, play a very deciding part in the balancing operations.

The "bob" weights are clamped around the "throws" of the crankshaft to create a piston and rod assembly condition.

The cranks are placed on a hydraulically clamped polishing machine, the polishing agent in this case being ribbon type polishing paper. The abrasive used on this polishing paper is 320-grain; in other words, the dust must pass through a mesh screen of 320 spaces per inch.

The pressure exerted upon the paper is approximately 90 lb. The shaft rotates at 120-RPM for approximately 45 seconds under this pressure, which results in a highly polished face.

The quality of finish or polish is easily determined by the color change affected on the bearings. The light or "white" bearing indicates insufficient polish. An appearance of brown spots indicates a "burn" and must be re-polished with new paper. The desirable condition is a dark bearing, almost to a black, this being an extremely smooth finish. While the crank is being polished, an end-wise oscillating motion, of about 3/16 of an inch, is produced on the table carrying the crank.

As a comparative summary of the manufacturing advantages of the cast shaft, the following figures are given:

Forging weight: the forged crankshaft weighs 80 lb. rough, 65 lb. finished; the stock removed by machining is 15 lb.

Casting weight: the cast crankshaft weighs 72 lb. rough, 62½ lb. finished; the stock removed by machining is 9½ lb.

Machining-minute cost: time required for machining forging is 39 minutes; time required for machining casting is 34 minutes; the time saved is 5 minutes.

Grinding-minute cost: time required for grinding forging is 44½ minutes; time required for grinding casting is 29½ minutes; the time saved is 15 minutes.

Balancing-minute cost: time required in balancing forging is 12¾ minutes; time required in balancing casting is 12¼ minutes; the time saved is ½ minute.

The total saving in machining and straightening is (20) twenty minutes on each crankshaft. The elimination of all straightening operations contributes largely to this saving.

Synthetic Rubber in Russia

FROM an item in *Automobiltechnische Zeitschrift* it appears that Russia is leading at present in the production of synthetic rubber. Whereas such rubber is produced in the United States from acetylene (Duprene) and from salt, gas and sulphur (Thiokol), in Russia it is made from alcohol distilled from grain mash. The process employed is known as the SKB. In the first stage, water and hydrogen are separated from the alcohol with the aid of a mixture of catalysts, and butadien is obtained, which is then converted into rubber by polymerization, metallic sodium being used as a catalyst. This polymerization is effected in so-called polymerization chambers in which the liquid butadien, which has a boiling point of 23 deg. F., is brought into intimate contact with the metallic sodium.

The mechanical properties of the synthetic rubber thus produced are

(Turn to page 102, please)

The Horizons of Business

By Joseph Stagg Lawrence

Monopoly—A Useful Villain

THE Lion of Idaho, the Messiah in the White House, Honest Harold Ickes and sundry other statesmen have recently taken the lists against that hoary villain, monopoly. This wicked old performer has rendered yeoman service to hard-pressed politicians in the past whose stock of fire-and-flint issues was running low. On such occasions it has always been possible to release the flood gates of rhetoric, to charge the eyes of the orator with a kindling flame and arraign the enemy of mankind. On the general evil of monopoly the statesman may become unequivocal, vigorous and militantly righteous — with complete safety to his own political hide. Of course he could declaim passionately upon the Ten Commandments and the multiplication table or recite the Gettysburg Address. Unfortunately the former would lack purpose and the latter propriety. Hence, hail monopoly, the enduring sawdust bag of the hard-hitting political pugilist.

Sound and Fury (?)

Some segments of the public are not entirely satisfied with vibrant sound, measured beats, and gymnastic gestures even when they are directed against so sinister an object as monopoly. This fastidious element craves substance in the speeches of its public servants.

Both parties have planks against monopoly. Mr. Borah has let it be known that no subject is nearer his heart. He can see no greater peril to the commonweal than monopoly. Mr. Ickes has denounced the steel masters for submitting identical bids on his projects. There is a charge of collusive bidding and the threat of an investigation by the Department of Justice. This being a campaign year the threat may take real form.

It might be well at this stage, therefore, to look at monopoly, to define it, to examine some of its manifestations in the United States and see if it is as injurious as some of our earnest public servants would have us believe.

Origin of Anti-Monopoly Sentiment

The fear of monopoly is old. The English common law prohibited three commercial practices which are now quite common but were believed at the time to give the operators a monopoly power, i.e., an unfair economic advantage over their fellow citizens. These practices were known as "forestalling," "engrossing" and "regrating." The first referred to the purchase of a commodity by a merchant before his fellow merchants had an equal opportunity to contact the supply and bid for it. Engrossing meant the accumulation of a larger supply than was strictly necessary in the business in order to profit by the sale of the surplus. Regrating meant the sale of material whose form had not been changed at a price above that at which it was purchased.

Obviously these restrictions were designed as much for the benefit of other merchants as for the protection of the public. In fact, since the guilds themselves largely determined the custom which later acquired the force of law, it may be assumed that consideration of the public had little to do with the taboos. These practices are known today in common business parlance as "beating the other fellow to it," "cornering the market" and "selling at a mark-up." No stigma, legal or customary, attaches to them. The early guilds justified these taboos on moral grounds. They claimed that the fellow who reached the seller first, cornered the supply or bought so shrewdly that he was able to get a mark-up, did no work upon his goods, therefore added no value to them and certainly should not be paid for a value which he did not create by the toil of his own hands.

The Seed of Monopoly

The second of these three practices, namely, engrossing, contained the germ of monopoly. Monopoly is an economic power. It is the power to control a sufficient portion of the total supply of a particular commodity to effect changes in the price of that commodity. A farmer who produces ten bales of cotton can withhold or sell his crop without affecting, except in a most remote theoretical sense, the market price of cotton. Suppose now that every cotton farmer agrees to transfer the disposition of his crop to a government bureau. Such a bureau then has monopoly power since it can determine the market price of cotton in this country by regulating the amount of the staple which is offered for sale. Note that there are two elements in this power of monopoly, first, the control of all or a substantial portion of the supply and, second, a regulation of the price flowing from the control of the supply.

This incidentally is the concept of monopoly accepted by orthodox economists. If you will play with the idea a bit you will soon realize that there is no such thing as a perfect monopoly or even an approximate monopoly. This is due to two compensating restraints, elasticity of consumption and the power of substitution.

Weapons of Defence

The first of these, elasticity of consumption, may be illustrated by the automobile industry. Assume that Chrysler, Ford and G. M. were able to combine, were stupid enough to do so, denied the use of patents to possible competitors and proceeded to raise the price of cars in order to, let us say, "increase the purchasing power" of automobile workers, producers of parts and materials and stockholders. So contrary has been the actual policy of the industry and so skillfully has this policy been explained to the public that any school boy could tell us what would happen if the Big Three combined and as a "monopoly" raised the price of cars. The consumption of cars would diminish. Here we have "elasticity of consumption," the automatic safeguard of the consuming public operating to penalize the ambitious monopolist who mistakenly believes that he can profit more by restricting production and charging higher unit prices. It is of interest to know that public utilities which have some monopoly attributes have found it more profitable to lower

(Turn to page 102, please)

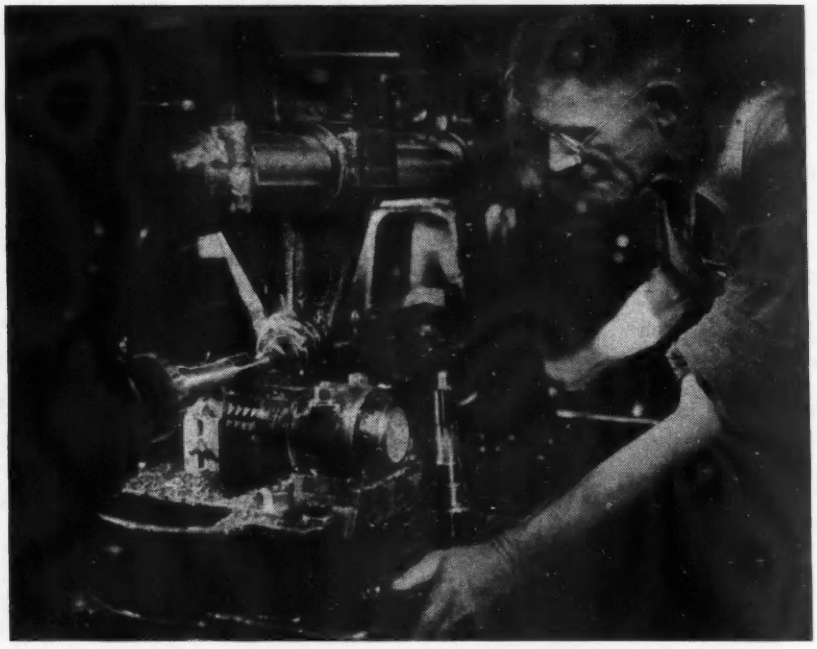
"4640" the Unknown-

By E. F. Davis*

ALTHOUGH the nickel-molybdenum steels were reported on favorably more than twenty years ago, and steels containing 3 per cent nickel, 0.90 per cent chromium and 0.50 per cent molybdenum was used in 1918 for crankshafts of Liberty engines, this series of steels was much neglected until the last few years. In 1925, for example, no molybdenum steels were included in S.A.E. specifications, although at that time steels of that type were being tried for gears and axle shafts. The S.A.E. 4615 carburizing grade of nickel - molybdenum steel appeared first in the 1930 edition of the Handbook, the 4640 only in the 1935 revision.

Introduction of low - carbon nickel-molybdenum steel in automotive practice dates back considerably further, however, for in 1921 the carburizing grade was used by Studebaker for shafts and pins, and the analysis was patented by that firm. Four years later the same type of steel was adopted by Timken for anti-friction bearings. But these steels did not attain their deserved popularity until the steel companies had mastered control of grain size. Refinement of their grain structure increased their value and utility and put them on a par with the dependable 3½-per cent nickel steels. Today S.A.E. 4615 (or 4620) is one of our most widely-used alloy carburizing steels for rear-axle ring gears, pinions, transmission gearing, shafting and a multitude of other applications.

The 3½ per cent nickel-molybdenum steel, now designated as S.A.E. 4815, is today often substituted for purposes where 5 per cent nickel steel was formerly specified. Although not equal as a constructional material to the old reliable S.A.E. 2512, it anneals with less difficulty, shows slightly improved machineability, and gives a higher surface hardness after heat treatment. The 5 per cent nickel steels, although nominally martensitic when carburized and hardened, sometimes produce an austenitic skin on the case unless these operations are carefully controlled. The 3½ per cent nickel-molybdenum steel, S.A.E. 4815, is used to advantage in certain types of rear-axle gearing, bearing races, free-wheeling shells and for other purposes where a file-hard surface and a hard core are requisites.



Hobbing splines on a shaft of 4640 steel.

The medium-carbon type of nickel-molybdenum steel, now classified as S.A.E. 4640, is not yet a popular steel, judged by the extent of its application and the tonnage used, and its value as an engineering material is almost unknown to many steel users. A survey of two prominent steel plants indicates that 90 per cent of this steel manufactured at the present time is consumed by the Warner Gear Company. Yet this steel possesses unusual properties which should make it desirable for many purposes, and it should fit particularly into the gear industry. The Warner Gear Company first adopted it as a standard composition for automotive gears in 1932, and we have found it superior to any other oil-hardening gear material.

The analysis range as specified by the company is as follows:

	Per Cent
Carbon	0.35-0.40
Manganese	0.50-0.80
Phosphorus	Max. 0.04
Sulfur	Max. 0.05
Silicon	Max. 0.25
Nickel	1.65-2.00
Molybdenum	0.20-0.30

This conforms to standard S.A.E. 4640, except for a five-point carbon range, which is deemed necessary for closer control of metallurgical operations.

Mechanical Properties

From a structural standpoint the chief advantage of this steel is its high

*Metallurgist, Warner Gear Co.

One manufacturer uses 90 per cent of entire production of medium-carbon type of nickel-molybdenum steel

Low - and - second - speed gear blank in annealing oven

fatigue resistance, due to its ability to develop high tensile values by heat treatment without a corresponding loss of ductility. The results of dynamometer runs of transmissions containing gears of this analysis have always been very gratifying. At this plant the Sprague dynamometer is used, and it is customary to test transmissions at 30 per cent above the maximum torque developed by the engine of the car for which the unit is designed. This steel frequently shows three to four times the life obtained from chromium steels of the same carbon content. This, of course, has increased the life of the gears in motor cars and has permitted raising the power limitations by about 10 per cent. However, substitution of this steel is not a panacea that permits of indiscriminate overloading of gears, for deflection of shafts and insufficient bearing supports are also factors in gear failures.

The figures in Table I show tensile values of this steel obtained from test specimens that were heat treated to a gear hardness of C52 to C54 Rockwell by the heat treatment shown in the table.

The Izod impact results of 10 specimens given the same heat treatment as those in Table 1 were as follows:

Specimen No.	Impact Ft. Lb.
1	5
2	6
3	5
4	5
5	6
6	5
7	5
8	5
9	6
10	6

Although these Izods* are low, as might be expected considering the high hardness obtained, they compare favorably with those of S.A.E. 2350 and are better than those of S.A.E. 5140 and S.A.E. 5150, three more widely used gear steels. The latter steels, heat-treated to gear hardness, usually show 3 to 4 ft.-lb. impact and have a tensile strength averaging about 250,000 lb., a yield close to 170,000, and an elongation of 8 per cent and a reduction of area approximating 22 per cent. The impact value of S.A.E. 4640 is lower than that of S.A.E. 2340, which would average 8 to 10 ft.-lb., but such steels would not produce as high cyanide-case hardness for the oil-treated gear. The preceding data, with due allowances for variables, serve only as an indication of the high rating of this steel in comparison with standard gear steels. Its high strength and hardness without brittleness give it high rank as a fatigue-resisting material.

Less Distortion in Heat Treatment

Next in importance to the static and dynamic properties is the comparatively low tendency to volume changes and distortion of the metal in heat treatment. Gear makers talk in ten-thousandths of an inch, and the ideal steel is one which goes through the phenomena of heat treatment without warpage or volumetric change. It is generally true that the lower the hardening temperature the less distortion occurs, although this rule is dependent upon the grain size and depth-hardening characteristics of the material in question. One advantage of this steel is its low critical points. Passenger-car gears can be hardened readily by an oil quench as low as 1420 deg. Fahr. and yield Rockwell hardness readings as high as C50. The steel will also harden satisfactorily with the minimum of agitation in the quenching media. Un-

* V-notch type impact specimens were used. These were hardened at 1450° F. in lead for 15 minutes, quenched in oil and tempered at 400° F. Cyanide cannot be used on V-notched specimens, for all steels show about the same—1 to 3 ft.-lb.—which is due to the brittleness of the cyanide in the "V."

Table 1—Tensile Strength of S.A.E. 4640 Steel

Specimen No.	Yield Point lb. sq. in.	Tensile Strength lb. sq. in.	Elongation, Per Cent	Reduction of Area, Per Cent
1	181,500	291,000	12.7	38.4
2	184,000	292,000	12.0	32.6
3	185,000	293,500	10.5	30.7
4	185,500	291,500	11.2	33.8
5	182,500	294,000	10.4	36.0
6	183,000	292,500	10.2	33.4

less the mass is too great, gears may be immersed in still oil without agitation of either the parts or the oil, except the natural flow of the quenching fluid resulting from its contact with the hot metal. It also lends itself to delayed quenching and other "trick" heat treatments, which are sometimes necessary for the purpose of eliminating distortion. All of these properties help to reduce the gear maker's problems.

Modern designs of transmissions are complicated affairs, with clutching cones, internal teeth, and various sharp changes in sections, which makes their heat treatment a difficult matter. Furthermore, the helical tooth, which is used almost universally in passenger-car transmissions, introduces a change in helical angle in heat treatment in addition to the changes of involute. Obviously, the steel which may be heat treated with the mildest quenching action has the best chance to survive the vicissitudes of the hardening operation without excessive warpage. It also gives the engineer more leeway in designing a gear or clutching member which is practical from the heat-treating standpoint.

Fig. 1 — S. A. E. 4640 steel, showing "forging structure." Hardness, 241/255 Brinell. Magnification, 300

Open Hearth Steel Used

Most of the steel used by the Warner Gear Company until late in 1935 was of electric-furnace manufacture. All made to date has been of a fine-gained type (6 to 8 grain size according to the A.S.T.M. Chart). This fine grain has aided in a great measure in producing the desirable properties. The following information relates to steel meeting these essential requirements and purchased with a five-point carbon range, which has been readily obtainable with the electric-furnace product. However, with the cooperation of a prominent alloy-steel company, an excellent grade of open hearth S.A.E. 4640 steel has been produced, and up to the present time no marked difference has been noted in reaction to annealing, machining, tooth finish or distortion, between the open-hearth and electric-furnace products.

It is the practice at this plant to heat treat parts made of this steel directly in cyanide without any preliminary preheating, except to dry the parts and warm them slightly before immersion in the molten-salt bath. No distortion has resulted from this procedure. The cyanide case is usually about 0.006 in. deep and is file-hard, assuring a good wearing surface on the gear teeth. The fact that the cyanide prevents surface oxidation further enhances the quenching effect. The core hardness of this steel is usually over 500 Brinell, but this is governed by the mass or section size. The nitrides in the cyanided area, although brittle, exert little influence unless the parts have sharp corners or the sections are very thin.

Manufacturing Tolerances

A citation of some of the results obtained with this steel may seem a gross exaggeration, but its valuable attributes have been confirmed by four years experience with a multitude of parts, some of which have been of considerable volume. A synchronizing clutch ring of S.A.E. 4640 having an internal diameter of approximately 2½ in. is held within 0.0015 in. in the hole. This particular part has been in production for about eighteen months, with a production of 4000 to 6000 daily. In this period, over 90 per cent of these did not vary over 0.0005 in. in dimensions after heat treatment. The variation in the remaining 10 per cent (from 0.0005 in. to 0.0015 in.) was due to a slight out-of-roundness. An overdrive annulus

Fig. 2—Acicular or pseudo-martensitic structure, resulting from improper annealing. Hardness, 207 Brinell. Magnification, 300

of this same steel, measuring approximately 5½ in. in diameter, with an out-of-roundness limit of 0.0025 in., was held practically one hundred per cent within these limits. The machining tolerance was 0.0015 in., hence these came out of heat treatment practically the same as they entered. The splined holes of gears have shown practically no expansion or contraction, and the backlash of gears has been held more nearly uniform, due to less movement on the outside diameter. These tolerances would have been considered impossible prior to the introduction of this steel.

Effect of Alloying Elements

An analysis of the effects of the various constituents in the S.A.E. 4640 steel, reveals the reasons for these superior qualities. Nickel, the principal alloying constituent, dissolves in the iron in all proportions and exists in solid solution in the ferrite. The function of nickel is to strengthen the fer-

Table II—Torsional Tests on S.A.E. 4640 Steel

Specimens treated in full test size, gage length 1 in. rd. by 8 in. long. Specimen No. 1 was heated to 1475 deg. Fahr. in cyanide. Specimens Nos. 2 and 3 were heated to 1500 deg. Fahr. in cyanide, and Specimen No. 4 was heated to 1525 deg. Fahr. in cyanide. All specimens heated for 30 minutes, quenched in oil and drawn to 400 deg. Fahr. in oil for 45 minutes.

Specimen No.	Rockwell C on Surface	Torsion Elas. lb. per sq. in.	Tors. Ult. lb. per sq. in.	Degrees Twist per inch		Total Twist per 8 in.	
				Tors. Elas.	Tors. Ult.	Tors. Elas.	Tors. Ult.
1	46-55	96,800	188,200	.92	8.5	7.4	68
2	47-55	94,300	189,200	.985	9.3	7.9	74
3	47-52	96,800	181,700	.93	9.1	7.5	73
4	50-55	91,800	174,900	1.01	8.0	8.1	64

rite without impairing the ductile properties. Nickel also depresses the critical points, thus permitting low-temperature hardening, as it does in the 3½- and 5-per cent nickel steels. Nickel, of course, increases the percentage of pearlite; thus, with a content of approximately 3½ per cent nickel, the eutectoid is reached at about 0.72 per cent carbon, instead of 0.87 per cent carbon for an unalloyed steel.

Carbon, of course, combines with the ferrite and contributes the hardening properties of cementite. Molybdenum associates with both carbides and ferrite, and its effect is similar to that of chromium. Molybdenum serves to increase the hardenability by raising the A^c point and lowering the A^r point. This is very evident when we compare the hardness obtained with a standard 3½ per cent nickel steel and a 3½ per cent nickel-molybdenum steel of the same analysis except for 0.25 per cent molybdenum. If both steels are carburized and hardened, the surfaces of the latter steel will be several points higher in Rockwell hardness.

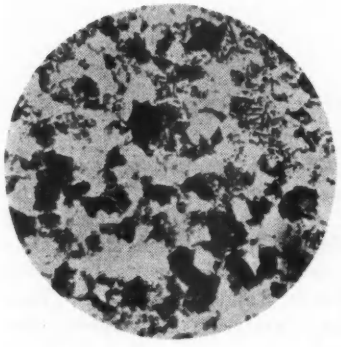


Fig. 3 — Correctly annealed S.A.E. 4640 steel. Hardness, 207 Brinell. Magnification, 300

The addition of molybdenum to nickel steels also has the effect of dispersing the carbide so finely that the lamellar pearlite pattern is seldom found in an annealed sample under the microscope, the steel passing directly from the sorbitic to the spheroidized microstructure. In spite of this, the steel seems to be in a state of stable equilibrium, with stresses so well distributed that cracking has never been experienced after the quench; whereas some of the oil-hardening gear steels, especially those with higher carbon contents, are more sensitive and are liable to crack unless tempered very soon after quenching. No doubt the fine grain, the finely distributed carbide, and the balanced stresses account for the small movement of the metal during quenching.

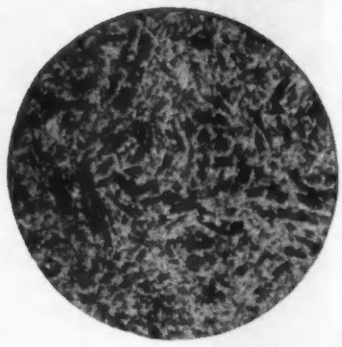


Fig. 4—Correct structure of S.A.E. 4640 steel after heat treatment (for Warner gears). Magnification, 500

Fabrication Characteristics

No trouble is experienced in forging this steel. While not as free-scaling as the chromium types, it does not form a tight, hard scale. Ordinary tumbling of forgings will suffice to clean them, and pickling is seldom necessary. A typical forging structure is shown in Fig. 1.

Being a fine-grained type, it shears readily if proper precautions are taken in the steel mill not to allow the bars to cool too fast after the rolling. It is the general practice to pit-anneal the bars consigned to forge plants, to facilitate cold shearing. The bars shear with a clean cut and very little trouble has been reported.

Annealing for maximum machinability is not as readily performed with this steel as with the chromium and straight nickel steels of the same carbon content. When continuous annealing furnaces are employed—which is the common practice in the gear industry—the steel is pushed through a heating zone in regular time increments and brought to a high enough temperature to assure complete solution of the constituents. This temperature may be from 1550 to 1750 deg. Fahr. After the steel is brought up to heat, it is given a fast drop to 1200 deg. Fahr., which may be from 125 to 175 deg. Fahr. per hour. If the steel is not completely in solution, an acicular structure, sometimes called pseudo-martensite, is formed, as shown in Fig. 2. Steel containing these needle-like crystals is very difficult to machine, even though the Brinell hardness may be below 200. To eliminate this acicular structure, the steel must be raised to a higher temperature or it must be kept hot a longer time to permit complete solution. This steel usually anneals at 196 to 217 Brinell. Fig. 3 shows a standard annealed structure.

The machining properties of this steel are fair. Owing to the fine grain and absence of blocky pearlite, it cannot be said to equal the chromium and the coarser-grained plain nickel steels. Nevertheless, it should not be regarded as difficult to machine. It turns and threads readily, and in gear cutting gives a tooth finish at least equal, if not superior, to other fine-grained steels.

This type of steel is somewhat more subject to "banding" than many of the other alloy steels; this, however, is caused by defective steel-mill practice and may exist in any of the alloy types. Banding is a series of ferrite "ghosts" in layers between longitudinal areas richer in carbides. Such a structure interferes with annealing and hardening processes. The banded steels, for example, are more liable to form the acicular structure during annealing and more liable to distort in heat treatment. However, a slight banding does not seem to show any unfavorable effects. An example of very badly banded structure is shown in Fig. 5.

Summary

The valuable properties of this steel may be summarized as follows:

1. High tensile properties.
2. Excellent impact values.
3. High fatigue resistance.
4. Good surface hardness.
5. Wide heat treating range.
6. Minimum distortion in heat treatment.

A survey of the applications of this steel shows it to be used at present for gears, transmission shafting, overdrive annuli, synchronizing collars, clutch shells, side plates and high-tensile bolts. This steel really deserves more popularity than it has at present, and when its excellent properties are better known and appreciated no doubt it will find many additional applications in industry.

Fig. 5—Badly banded structure. Magnification, 100

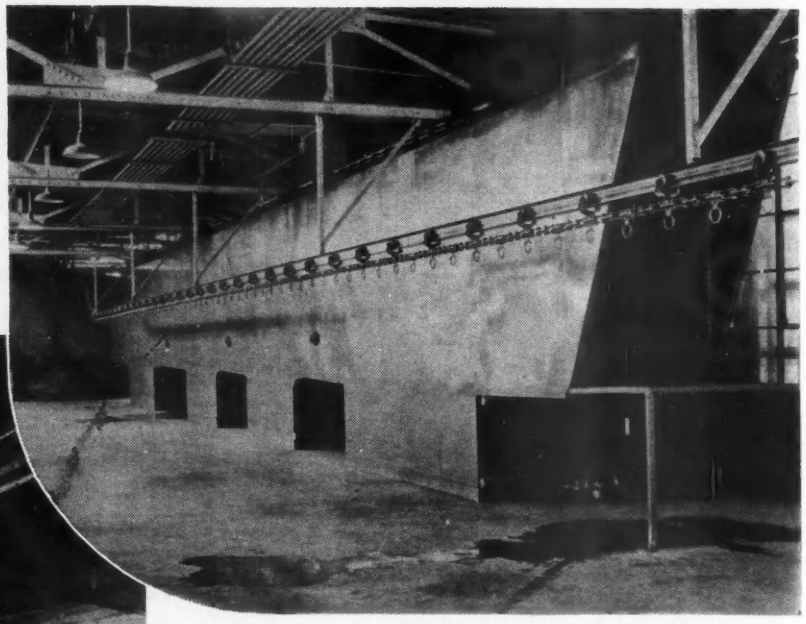
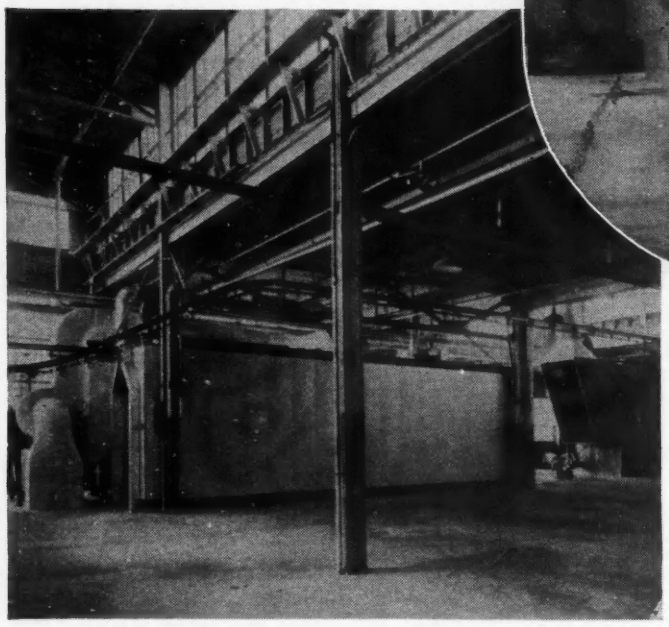


Fig. 1 (right). Bonderite spray system prepares the metal surface for the three types of finish used in this plant.

Fig. 2 (below). Burn-off oven after Bonderizing is operated at 450 deg. F. It is heated with propane of 2500 b.t.u. value.



Small Parts &

ONE of the large automobile companies recently found it necessary to expand in order to take care of their increased production requirements. After due consideration, it was decided that the expansion should take place in one of their suburban plants, due to limited space facilities in the main Detroit plant.

In the newly expanded plant were to be manufactured such parts as fenders, dashboards, and other equipment. Because of the varying demand for finishes which may run from ordinary black japan to Duco, or new synthetic enamel, it was necessary that the plant be set up to operate under the three methods of manufacture and to incorporate a varying line of ovens. Fortunately the preliminary preparation of the material before covering with protective and decorative coating is similar.

The material is passed through a Bonderite spray system, occupying a space 106 ft. long by 12 ft. high by 6½ ft. wide, shown in Fig. 1. The overhead monorail system was employed for the depositing of the Bonderite material. Because of the building arrangement it was necessary to build the unit in the form of an inverted "L."

The dry-off after Bonderizing spray utilizes an oven of the overhead conveyor type (Fig. 2) having internal dimensions of 32 ft. long by 14 ft. wide by 10 ft. high, and consists of a number of internal passes in order to obtain the time desired in the oven. The oven is to be operated at 450 deg. F., and is constructed with heavy Rockwool insulation, built into special panels. It is operated as a direct-fired recirculating system, suitably protected and provided with automatic safety devices. The heaters on this job are of the surface combustion atmospheric type, utilizing propane gas of 2500 B.t.u. supplied under pressure from the storage tank adjacent to the plant.

The control system on the unit consists of Minneapolis-Honeywell protectoglows together with suitable relays, pressure devices protecting against gas failure, protection devices insuring that the circulating fans are running, and a fully automatic ignition circuit.

At this point the method of manufacture divides, and the three methods of manufacture are described individually.

Such parts as are to be black enameled are passed through a dip tank and then through the black enamel oven, Fig. 3, of flat multi-pass type having internal dimensions of 42 ft. long by 20 ft. wide by 9 ft. high, operating at 300 deg. F. It is constructed with heavy Rockwool insulation, suitably manufactured into standard panel, and operating as a recirculating system, direct-fired.

The dip units are shown to the right of Fig. 2 and are not clearly illustrated. From there the parts pass up and into the oven after suitable draining time, and after multi-passes through the oven, issue to the left and carry on to the plant for various assembly procedures. The heater on this job is of the atmospheric type, utilizing propane under pressure, and recirculating with fully automatic safety protection. Automatic oil filters of a new and novel design are provided.

Beginning at the dry-off after Bonderizing, Ducoing, the second method of manufacture takes place. From this point the material goes through a special type of spray booth and then passes through a multi-pass oven for Duco baking. This oven is 28 ft. long by 18 ft. wide by 9 ft. high, operates at 200 deg. F., and is constructed of heavy Rockwool insulation in standard steel panels. The heater on this job is a surface combustion atmospheric direct-fired unit of the same type as used on

* Surface Combustion Corporation.

the other oven, supplied with propane under pressure.

The synthetic setup calls for the spraying of the material with synthetic lacquer in a spray booth of the water type, where the pigment is recovered through precipitation in water. The work then passes directly on the overhead monorail system into a first coat synthetic oven of multi-pass overhead conveyor type with internal dimensions 60 ft. long by 20 ft. wide by 9 ft. high, operating at 300 deg. F., and constructed of suitable panels with heavy Rockwool insulation. The heater for this job is of the recirculating, atmospheric, direct-fired type, operating with propane of 2500 B.t.u. quality, and with complete safety control.

After the material is baked in this oven it passes into an enclosed spray booth system in an entirely sealed room in which air is supplied under pressure, and removed in exact balance so that no air can enter from the plant itself.

A new and novel type of heater, Fig. 4, utilizing the radiant tube heating element system whereby diffusion combustion principles are applied, constitutes the heater equipment supplied for the finish coat. The oven is 28 ft. long by 18 ft. wide by 9 ft. high, operating at 300 deg. F., and is of the multi-pass type. Utilized in this is also the continuous oil filter, the construction of which is quite similar to that for the first coat synthetic oven. The unit is provided with safety devices, similar to those that have been described previously.

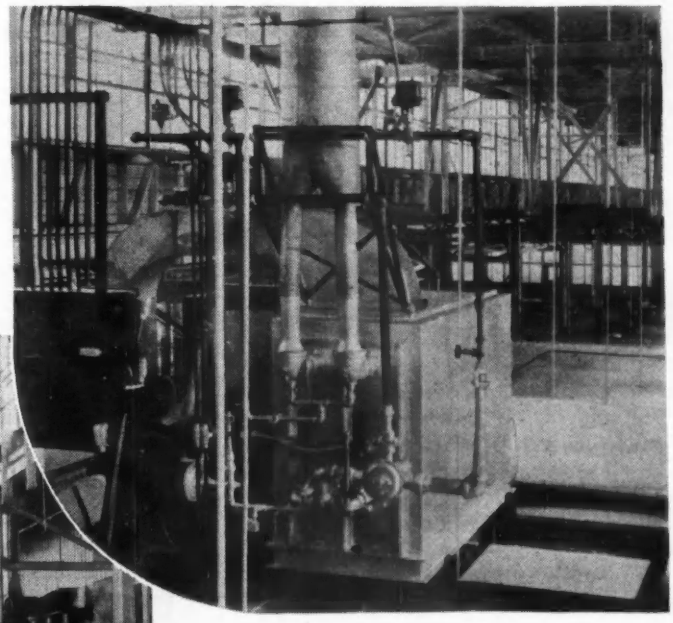
Careful study of plant conditions and operating conditions was made by the engineers in order to determine the proper relation and flow of equipment through the plant. The delivery of finished material from either the black enamel, Duco, or synthetic processes, all ends at approximately the same point in the plant. Conveyor systems are so designed that all materials flow to the necessary assembly points from the japanning plant, and still utilize to the best extent the 160 x 400 ft. area.

The oven equipment, spray booths, and ventilating systems were installed by the Newcomb-David Oven Company of Detroit, Mich.

are Carried Efficiently

by a conveyor system which synchronizes production of spray booths and ovens

By Edward Stephenson, Jr.*



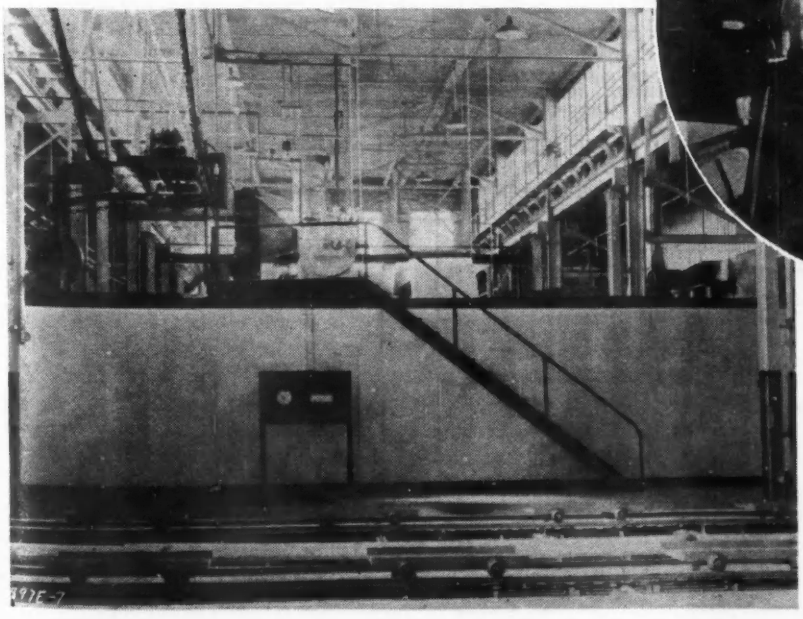


Fig. 3 (left). Black enamel parts are baked in this direct-fired, flat multi-pass oven. Operating temperature is 300 deg. F.

Fig. 4 (above). New type S-C heater utilizing radiant tube heating elements is used in conjunction with the oven for baking the finish coats on synthetic enamel jobs.

SOUNDS With A Common

The Technical Committee of the American Standards Association reports on bringing sound meters to a uniform basis of measurements

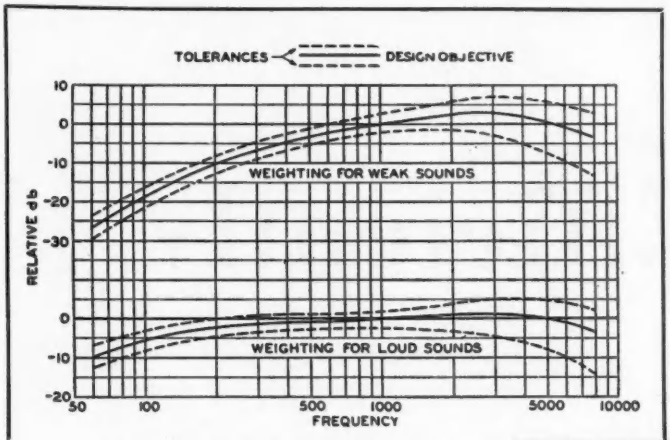


Fig. 1—Over-all free-field frequency responses and tolerances for sound-level meter.

TENTATIVE standards for sound level meters have been recommended by the Technical Commit on Sound Levels and Sound Level Meters of the American Standards Association, of which R. G. McCurdy of the Bell Telephone Laboratories is chairman, and approved by the A.S.A. The subject was discussed in a recent article by Mr. McCurdy in Industrial Standardization, the official organ of the A.S.A. Mr. McCurdy's article is reproduced here in slightly condensed form.

Fundamentally, the human ear must be the judge of the amount of noise which can be tolerated under a given set of conditions. However, individuals differ among themselves in their appreciation of loudness and in their reaction to various sounds, so that it is generally necessary to assemble a considerable number of observers when measurements are made by methods using the human ear and human judgments. Thus a strong demand was created for physical apparatus which would measure loudness or something related to it, and a number of different types of noise meter were designed and marketed.

Recognizing the advantages of standardizing the various meter characteristics, so that the same readings would be produced by a given noise whether measured by one manufacturer's instrument or another's, a technical committee was appointed to go into this matter. Since instruments of this type measure the level of any sound, whether or not it is characterized as unwanted, or noise, the broader title of "sound-level meter" is used, rather than the more restricted one of "noisemeter" or "noise-level meter."

Measurements of sounds by these meters will not necessarily agree with measurements of loudness which may be made by the ear-comparison methods conforming to the standards

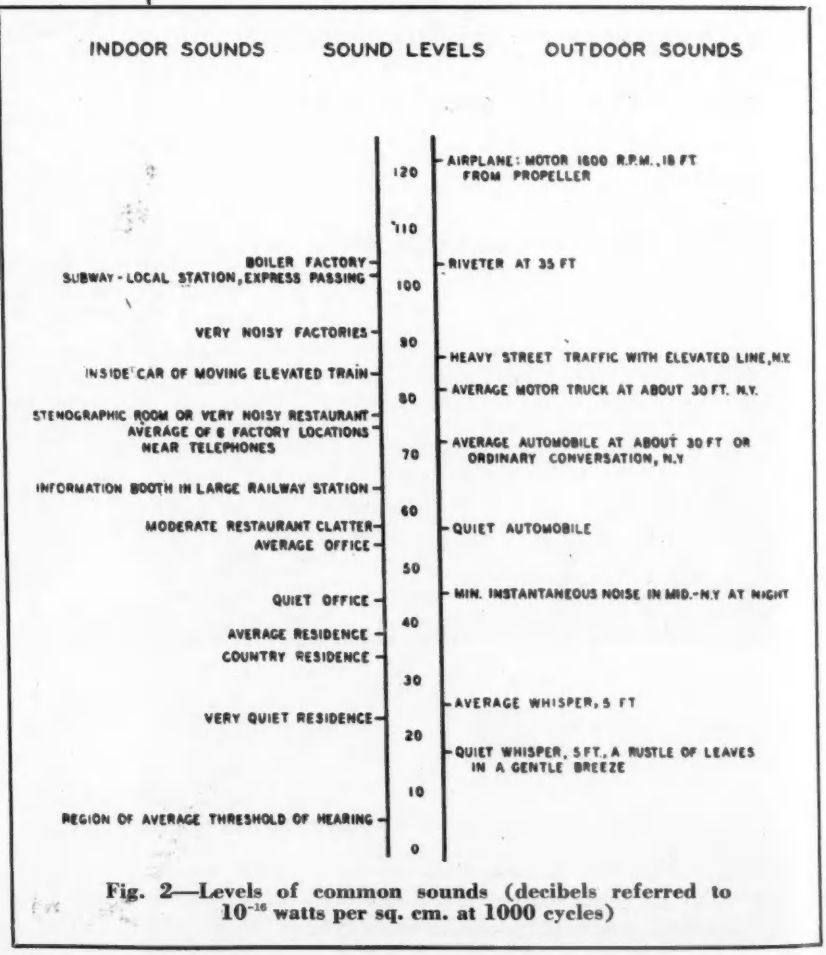


Fig. 2—Levels of common sounds (decibels referred to 10^{-16} watts per sq. cm. at 1000 cycles)

Denominator

for this type of measurement also just adopted by the American Standards Association.

The perception of loudness, and the judgment as to whether a given noise is or is not more disturbing than some other noise, is a complicated physiological and psychological reaction of human beings. It is probably too much to expect to be able to build all of these reactions into an electrical circuit. On the other hand, individuals differ among themselves as to judgments of loudness or of disturbance created by noises of different types, so that usually it is necessary to assemble a "sound jury" made up of a large number of individuals in order to obtain reliable results.

Meters have the advantage of ready portability, possibility of taking a large number of measurements in a short time, and assurance that the same noise will be measured the same at different times. It is believed that meters of different manufacture, built and calibrated in accordance with these standards, will agree among themselves, and that the same number will be obtained for a noise irrespective of whose meter is used in the measurement.

The essential parts of a sound level meter are the microphone, weighting network, amplifier, and indicating instrument. The microphone converts some of the acoustic energy in a sound field to electrical energy. The ear is capable of hearing a wide range of frequencies (about 40 to 16,000 usually) and these do not all sound equally loud when their acoustic pressures are the same. It is, therefore, necessary to provide a weighting network to attenuate the electrical energy corresponding to certain frequencies relative to other frequencies, in order to bring loudness shown by a meter into accord with the perception of loudness characteristic of the ear. The weightings which are being standardized for sound level meters are shown in Fig. 1. Flat weighting also is permitted. The amplifier raises the level of the weighted powers until their sum is sufficiently large to cause a deflection of an electric meter. On account of the tremendous range of powers which the ear can perceive but which cannot be accommodated on the scale of any simple electric meter, an additional control is usually used to keep the meter needle on the scale.

The meter measures the sound levels in decibels, using as a reference an acoustical power of 10^{-16} watts per square centimeter at 1000 cycles in a free progressive wave. This reference sound is about the weakest sound that can be detected by a person with hearing somewhat more acute than normal.

The control dial of a sound level meter is usually marked in steps of 5 or 10 decibels, and the indicating instruments is also marked in decibels so that the sound level is commonly determined by adding the reading of the control dial to the reading of the indicating instrument. The indicating instrument itself is designed so that the time required to attain any given deflection is about equal to the time required by the human ear to fully appreciate the sound causing the deflection.

In recent years many investigators have made measurements of a wide variety of sound with sound-level meters having characteristics corresponding closely to those given above. Fig. 2 shows the levels of some common sounds obtained from these investigations.

Testing Petroleum Products and Lubricants

IN its annual report, A.S.T.M. Committee D-2 on Petroleum Products and Lubricants presented numerous recommendations affecting standard test methods in its charge, all of these being approved by the A.S.T.M. annual meeting. The Tentative Method of Test for Gum Content of Gasoline (D 381—34 T) is to be adopted as standard with certain changes and a number of tentative revisions of standards were approved for submission to Society letter ballot, including the test for viscosity.

Committee D-2 and a number of subcommittees and technical committees held meetings during the annual meeting of the Society. The Subcommittee on Viscosity, J. C. Geniesse, Chairman, has prepared a modified Viscosity-Temperature Chart approximately one-half the size of the tentative standard chart (D 341—32 T). The modified chart will be letter size and will be more convenient to file with correspondence. The publication of the modified chart was authorized. The subcommittee is preparing Kinematic - Saybolt Viscosity Conversion Tables which will be based on the best available information. The tables are necessary for developing the usefulness of the two types of kinematic viscosity methods which are being published as information.

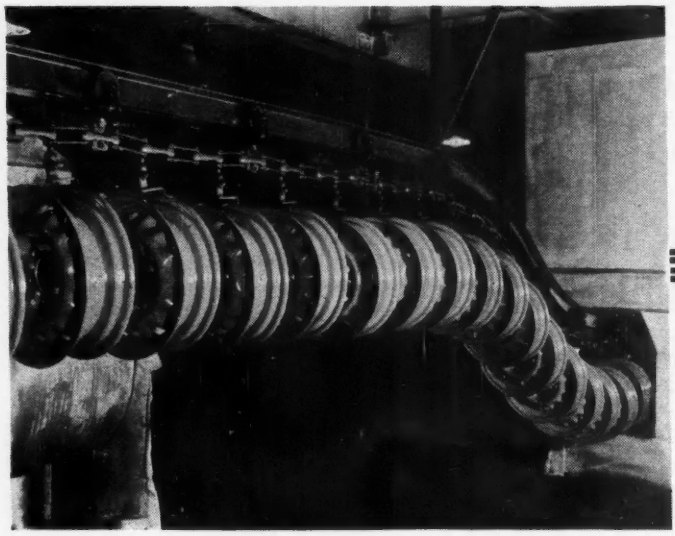
The Potentiometric Method for Neutralization Number, which has been developed jointly with Committee D-9 on Electrical Insulating Materials, is to be published for the information of the committee.

Technical Committee B on Motor Oils was authorized to form a new section on Engine Deposits, under the chairmanship of W. A. Gruse. An article has been prepared (under the chairmanship of L. L. Davis) which provides recommendations for a uniform practice of changing crankcase lubricating oil. The draft was approved and, subject to the favorable reaction from the entire committee, will be given wide publicity.

Technical Committee B accepted the responsibility of preparing and presenting a symposium on motor oils to be held in conjunction with the regional meeting of the Society at Chicago in March, 1937. The symposium will stress the new developments in automotive lubrication which have transpired since the previous papers were presented in the 1933 symposium.

Sectional committees of Technical Committee C on Fuel Oil proposed changes for the viscosity and ignition characteristics of the present classification of Diesel fuel oils, and also a number of changes in the specification limits of the present tentative specifications for fuel oils. The proposed changes are to be submitted to Technical Committee C for letter ballot, and,

(Turn to page 101, please)



PRODUCTION LINES

An endless procession of wheels from the railroad cars to the final assembly line in the Pontiac plant. Here they are going into the baking oven after having received the paint primer. Temperature in the oven is 420 degrees and the time required is 38 minutes.

Page Crobalt

A new cutting tool material—Crobalt—having made the grade in one of the large auto plants will soon be on the market. It has a wide range of usefulness and is said to be very low in cost. It will be available in the form of tool bits, and also in bulk for fabrication by individual users and tool manufacturers. We shall be glad to tell you more about it.

Trailers Deluxe

Three men out of the West, one of them being Duncan Forbes, of Gunite, decided to get something different in personal transportation. So they have contracted for three Aerocar trailers running around 4000 bucks apiece. They have everything your heart desires—living room and bedroom comfort, mechanical refrigeration, and a bar in connection therewith. These jobs are designed for living, the automobile being simply a source of power. The trailer interiors are finished in a special lining made by Western Felt—a handsome felt base leather facing available in any grain and any color.

Granpappies

This is being written as a tribute rather than as an exposure. We had the pleasure of lunching recently at the executive table in the Bendix dining room. Vic Kliesrath cut in at one point with the remark that he had one grandchild. Then Frank Willis admitted that he had two. And Karl Wise very modestly opined that since the day before he could boast of five. Gentlemen, that's a record of no mean accomplishment and unless you can challenge it, we chalk up another trick for Bendix.

Under Water

For many years it has been known that plain water (H_2O) was really an ideal cutting fluid where only a coolant was required and where corrosion was not a factor. In fact, one of Prof. Boston's classic studies on cutting of metals showed the virtues of water in quantitative terms. Which all leads up to the fact that several days ago we saw a battery of new machines intended for 1937 production, where the entire workpiece, a big forging, was being drilled while completely submerged in a water bath. This may not be the first example of its kind but it's the first we have seen.

Balanced Joint

Nineteen thirty-seven will see a new kind of universal joint with a novel slip joint design. Its chief feature is great lightness without sacrifice of strength or torsional rigidity, these elements being developed in such fashion that the joint can be balanced within limits hitherto unknown in passenger car work. If any extraneous vibration is introduced in the particular 1937 chassis we have in mind, you can bet it won't come from the joints.

Machine Deliveries

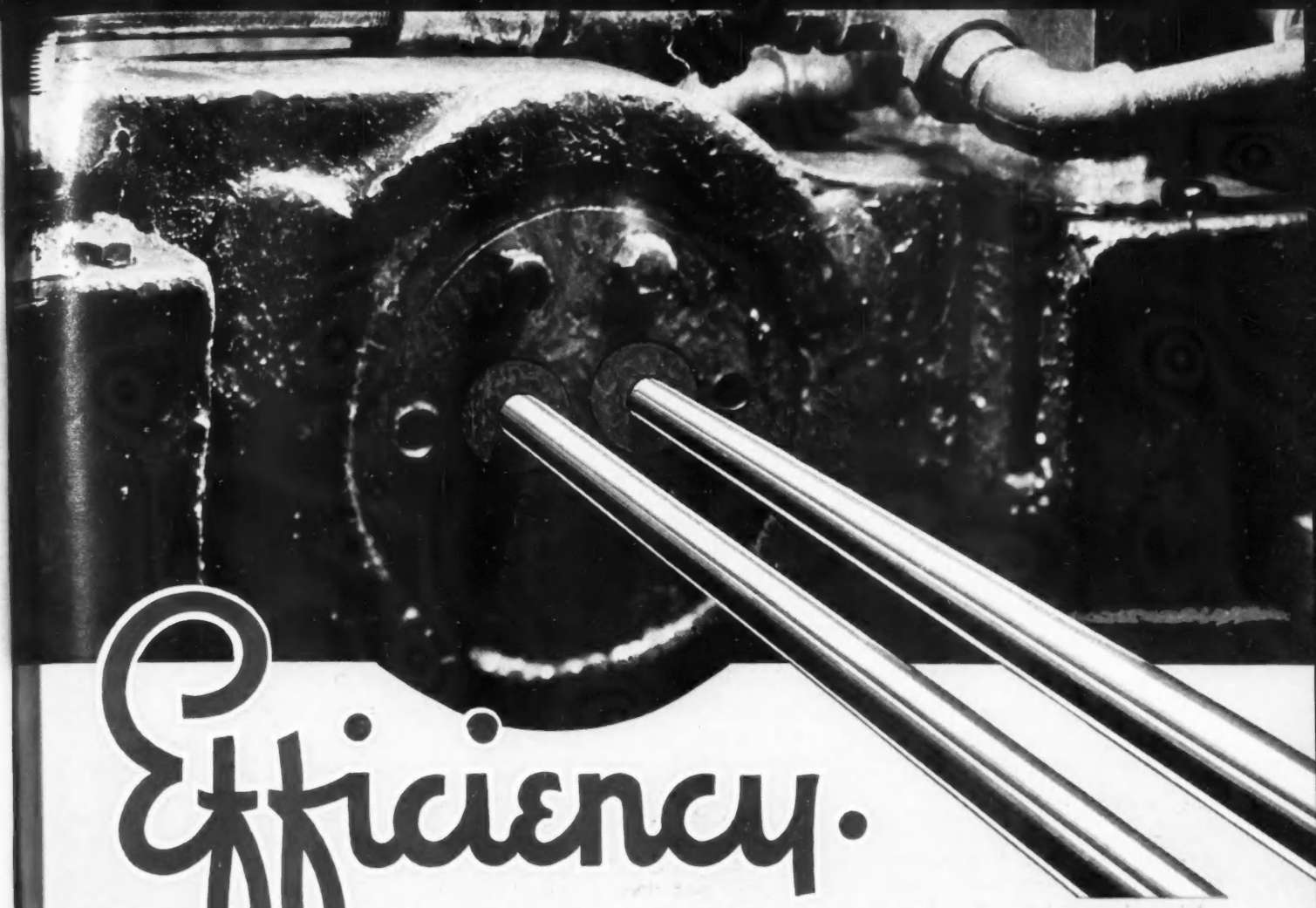
With the machine tool builders it's either feast or famine. If Rockford may be taken as an example, they are so crowded with new equipment orders that delivery promises start with a low of no less than around twelve weeks to a high of five months. And nothing can be done about it because everybody wants the new machines in a hurry. All of which indicates how smart it would be for at least some automotive producers to anticipate requirements and order new equipment during the periods of slackened activity.

Fishing Pole

Very popular out in the Middle West is a new radio antenna which is made exactly like a fishing rod. For installation, you drill a small hole in the cowl, push the end through and make the connection to the radio terminal. Then you glue the rod to the windshield glass, using the familiar vacuum cup. It sets up in the center of the windshield and projects bravely above the roof. The rod is of spring steel and bends freely to permit entry and egress through garage door openings.

—J. G.

MANUFACTURING MANAGEMENT METALLURGY



Efficiency.

. . . AN INHERENT QUALITY OF STEELS THAT ARE UNION COLD DRAWN

WITH UNION COLD DRAWN STEELS

• Efficiency is an inherent quality of Union Cold Drawn Bars because of their special characteristics and also because of their striking uniformity throughout duplicate lots. In run after run of steel through manufacturing operations they are found true and uniform to required size, cross section, finish, straightness and physical properties. This is accomplished with Union Drawn's highly perfected processes controlled by experienced judgment in production and frequent use of tests and inspections.

Mass production demands a constant flow of uniform materials. The qualities of incoming shipments must dovetail with those of previous deliveries so that shop practice proceeds without distinguishing one lot from another. The same steel and the same methods produce the same results and only this combination can maintain efficiency, once it is achieved.

Union Cold Drawn Steels have put many manufacturers on an efficient production basis and kept them there. These steels rank as first choice among those buyers who insist on the last penny in cost reduction.

UNION DRAWN STEEL CO., MASSILLON, OHIO

Manufacturers of Efficiency Steels

SUBSIDIARY OF
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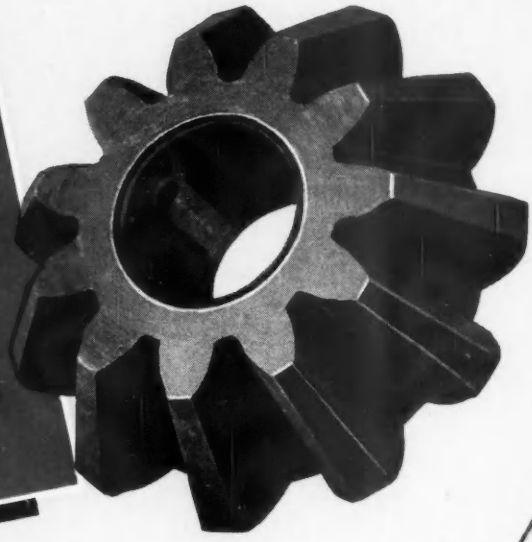
REPUBLIC STEEL CORPORATION

UNION DRAWN PROCESSING GIVES MAXIMUM MACHINABILITY TO Alloy Steels



• Radical improvements in the machinability of Union Cold Finished Alloy Steels have lowered the cost of machined parts made from the alloys.

Modern metallurgy has developed a wider understanding of the relation of microstructure of steel to its cutting qualities. Closely controlled annealing cycles supplemented by microscopic checks, and careful selection of proper cold working methods, enable us to make fullest use of this broader knowledge to develop machinability to a high degree. Once the requirements of fabrication are known, each lot of alloy steel can be processed to meet your needs for faster production.

Manufacturers who use alloy steel bars are invited to consult with Union Drawn Metallurgists on matters relating either to machinability or to selection of the most efficient steel grade for their requirements.

UNION DRAWN STEEL CO., MASSILLON, OHIO

Manufacturers of Efficiency Steels

SUBSIDIARY OF

REPUBLIC STEEL

REPUBLIC STEEL CORPORATION

Union Cold Drawn Steels

Testing Petroleum Products

(Continued from page 97)

if favorably received, will be offered to the entire committee for their reactions.

The biennial election resulted in the reelection of the present D-2 officers, namely, T. A. Boyd, Chairman; T. G. Delbridge, Vice-Chairman; R. P. Anderson, Secretary. The following members were elected to the Advisory Subcommittee: Messrs. Oberfell, Rogers, Dean, Farmer, Veal and Bridgeman.

Testing Methods for Rubber Products

At the 1936 A. S. T. M. annual meeting recently held at Atlantic City, one session was devoted to textile materials and rubber products. It comprised the reports of A.S.T.M. Committees D-13 on Textile Materials and D-11 on Rubber Products and a Symposium on "Limitations of Laboratory and Service Tests in Evaluating Rubber Products," which included five extensive papers.

In his paper dealing with "Methods of Evaluating Tire Performance," R. D. Evans of The Goodyear Tire and Rubber Co. stressed the possibilities of and limitations in rating tire quality. The principal tire elements, namely, the beads, carcass and tread, were briefly described and their functions and weaknesses outlined. While the paper does not give detailed descriptions, it does indicate the types of tests considered necessary. The author indicated that rotative tests are needed to bring out true bead quality and that to secure failure in a test or even to develop distress before deflection, it is necessary that the tire be run with a very high deflection, and simultaneously be subjected to frequently recurrent or continuous side thrusts of considerable magnitude, which requirement is difficult to provide in the laboratory. The discussion on the tire carcass was confined to three basic considerations, namely, the properties of the cord (type of fiber, construction, and twist details); "topography" (count and its path or angle); and finally the type, mechanical properties and distribution of the rubber compounds forming the cord matrix. The author mentioned that of the three major divisions the carcass is the only one whose over-all performance can be reliably estimated on the basis of inflated-tire tests in the laboratory.

With modern tires a test to determine the relative ability to dissipate heat by high-speed running, and thus to remain intact under centrifugal forces, is a subject of increasing importance.

The author concluded that road tests, extensive in scope, carefully organized in relation to the type of service for which the product is destined and expertly conducted and analyzed, provide the only sure way whereby the complete and undistorted picture of tire quality can be obtained.

The paper dealing with automotive parts by J. J. Allen of the Firestone Rubber Co. showed the value of various types of physical tests for evaluating such parts as engine mountings, bumpers, fan belts, etc. The tests for engine mountings, most of which are of rubber, determine the proper quality of rubber compound, the proper design of the part, and control tests determine the uniformity of the product after the part has been put into production. Low deflection curves, both compression and shear, and hardness measurement on the various rubber compounds for engine mountings are indicated as necessary. The hardness test is considered extremely important. One of those most frequently used by laboratories and inspection departments is to measure the degree of adhesion of the rubber to the metal.

The author indicated that since the failure of bumpers is usually the result of repeated shock, the laboratory impact test is valuable. Fan-belt testing is a good example of where accelerated laboratory tests can be used, the equipment consisting usually of a series of pulleys, one of which is driven by a motor and the other connected to a generator. The test is accelerated by using higher loads than those used in actual service and making the tests continuous. To determine resistance of various compounds to the action of gasoline, oil and water, the general method is to measure a volume of a suitable sample before and after immersing it in the desired liquid for a given period of time and at elevated temperatures.

In their paper dealing with "The Relation Between Laboratory Tests and Service Life of Rubber Hose and Belting," Messrs. W. L. Smith and Arthur W. Carpenter of the B. F. Goodrich Co. described in detail specifications and tests employed for hose and for belts. Dean Harvey, Materials Engineer, Material and Process Engineering Dept., Westinghouse Electric and Manufacturing Co., in his paper dealing with rubber-insulated wires and cables summarized results of an inquiry sent to a number of producers and consumers of rubber insulated cables, the Underwriters' Laboratories, the National Bureau of Standards, the United States Coast Guards and the U. S. Bureau of Mines. He indicated that a significant feature has been the trend toward performance specifications for purchasing rather than to specify the composition desired.

On the recommendation of Committee D-11 on Rubber Products, the A.S.T.M. meeting approved revisions in the methods of test for adhesion of vulcanized rubber to provide that the machine method may be applicable to both strip and ring specimens. Changes approved in the accelerated aging test eliminate unnecessary testing and make the test work more convenient when minimum specified requirements are established. Revisions which were referred to the Society for adoption were approved in the Standard Methods of Chemical Analysis of Rubber Products.

Ninety Years of Service

THE Akademischer Verein Hütte, well known as publisher of the Hütte Engineers Pocketbook, recently celebrated its ninetieth anniversary. This "Academic Union" was founded on May 16, 1846, by students of what was then known as the Royal Trade Institute, and later became the Berlin Technical College. The renown of the Hütte is largely based upon three enterprises launched during its first decade. First of all, it undertook the publication of working drawings of proven engineering installations. Such drawings were very hard to get at the time and they were therefore highly

appreciated. This work was later continued by the growing number of technical periodicals. The second accomplishment to the credit of the Hütte was the organization, on the occasion of its tenth anniversary, of the Society of German Engineers. Up to that time the membership had been recruited from among the student body of the Trade Institute, but it had now become evident that there was a real need for an organization including all German engineers, and the Hütte succeeded in forming an association whose membership extended over the entire territory now included in the German Reich, in spite of the fact that at that time the various German states were disunited. With its membership of approximately 36,000, the Verein Deutscher Ingenieure is claimed to be the largest engineering society in the world at the present time. The third task undertaken by the Hütte was the publication of its Engineers Pocketbook, which first appeared in 1856. It has had the collaboration of many men famous in German engineering and industry and it has recently attained its twenty-sixth edition.

In Mechanics Roller Bearing Universal Joints friction is reduced to the minimum. Then there is generous provision for lubricant. One "shot" reaches all four bearings on the cross equally, another fills the slip-yoke chamber. Highly efficient durable seals halt leakage of lubricant or entrance of dirt and water. These, and other outstanding advantages, are the reasons why Mechanics Universal Joints are used on leading passenger cars, trucks, and busses. Investigate. Write today for complete information.

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Horizons of Business

(Continued from page 89)

unit prices and increase their output.

Power of Substitution

The ability of the consumer to substitute operates almost universally as a brake upon the abuse of monopoly power. There is scarcely an article for which the consumer cannot find a more or less satisfactory substitute in the event that a misguided monopolist raises prices. The International Nickel Co. and the Aluminum Company of America, respectively, have what amounts to complete control of nickel and aluminum. Both metals are discovering new uses and becoming industrially more and more necessary. As a practical matter both companies regulate their prices with one eye on costs and the other on consumption. Cost defines the lower and consumption the upper limit of prices. If we examine other fields we find producers working under precisely similar limitations. There is neither princely privilege or predatory profit in monopoly. With the twin weapons of elasticity and substitution the consumer disciplines the rash monopolist and when the smoke of battle clears it is usually the monopolist who is licking his wounds.

All Roads Lead to Rome

(Continued from page 85)

tendency in Italy, as in other countries where gasoline is expensive, is all towards low-priced small 4-cylinder cars for ordinary use. In the cities there is a conspicuous absence of motor delivery wagons and trucks; nearly all the delivery service is done by motor tricycles with a parcel box behind the driver that holds almost as much as an ordinary automobile delivery wagon. For heavy long-distance hauling on the open roads, there are "road-trains," built by all the principal manufacturers of automotive vehicles, consisting of a powerful truck with a Diesel-type engine, followed by a trailer.

Synthetic Rubber in Russia

(Continued from page 88)

said to be excellent, and tires made from it are claimed to have a life of 22,000-25,000 miles. In addition to the process thus briefly described, still other processes are under development in the Soviet Union. It is claimed that during 1934 between 10,000 and 12,000 tons of synthetic rubber was produced in the country, and that during 1935 the output increased to between 20,000 and 25,000 tons.